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PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1850.

CIVIL ENGINEERING.

Experiments on Paddle Wheels for Steamers. *By* MR. GEO. RENNIE.*

I have read with much interest, in the Journal for July and August last, an account of a series of "Experiments on the Figure, Dip, Thickness, Material, and Number of the Paddles of Steamers, by Thomas Ewbank, Esq., of the City of New York, in the years 1845 and 1848," extracted from the Journal of the Franklin Institute. As Mr. Ewbank has devoted much time to these pursuits, and is the author of a valuable work on Hydraulic Machinery, his observations are entitled to attention.

The facts developed by his experiments may be briefly stated; they are as follows:—

1st, That, with equal areas and equal dip, triangular blades may be rendered twice as effective as ordinary rectangular ones; and this, too, while the propelling surface of the smaller number of floats was only half that of the greater.

2d, That, as the propelling power of a paddle is greatest at its greater or outer extremity, and diminishes to nothing at the surface, so its face should enlarge with the dip, and be nothing above—in imitation of the tails of fishes, the wings of birds, &c.

3d, That the fewer the number of paddles on a wheel the better, provided *one* be always kept in full play; and,

4th, That it would be more advantageous to point or fork them as proposed, to evade the jar of their striking the surface.

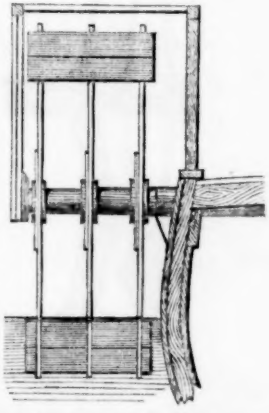


Fig. 1.—Ordinary System.

* From the London Civil Engineer and Architect's Journal, for September, 1849.

Mr. Ewbank concludes his paper by referring to the experiments made by me on H. M. steamer "African," in 1841, but which he had not been able to find, although similar experiments on two other vessels were published in your Journal for January, 1840, and subsequently in the Nautical Magazine for 1841. As the subject is now more interesting, I no longer hesitate to communicate the results.

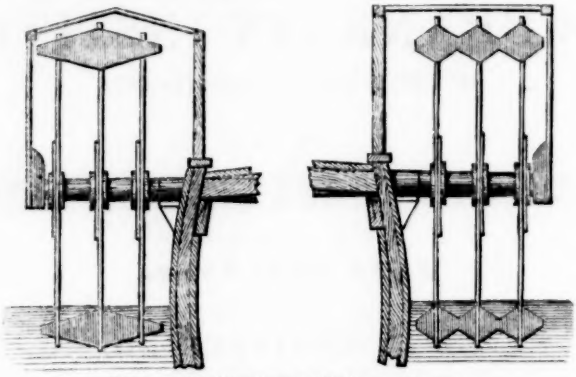


Fig. 2.—Modifications of Ordinary System.

In the year 1831,* my attention was attracted to this subject during the investigations undertaken for the purpose of ascertaining the laws of the friction and resistances of solids in motion in fluids, such as air and water; when, on causing disks or plates of metal to rotate round a fixed axle, by means of weights descending through given spaces and times, it was found

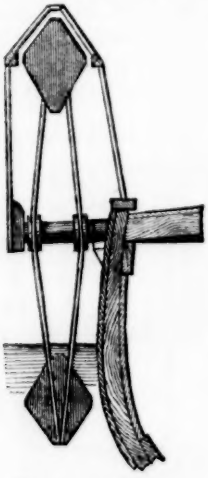


Fig. 3.
Improved Trapezium System.

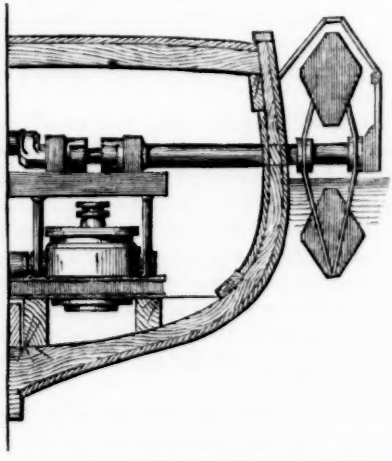


Fig. 4.—Improved Trapezium System.
With wheels of smaller diameter and greater velocity.

that, when a certain portion (one-fourth) of a rectangular disk or fan was intercepted from the interior part of the rectangle, so as to approximate to the form of a duck's foot, the resistance, whether through air or water, was

* See Philosophical Transactions for 1831.

the same—or, in other words, the resistance with *three triangular* or duck-footed floats was as great as previously with four rectangular floats. This apparent paradox was, however, accounted for on the principle of the interior or detrimental portion of the rectangular float being removed.

A series of experiments on two other vessels was again made in the years 1839, 1840, and 1841, by applying different shaped floats to paddle wheels of different diameters and widths, and on steam vessels of different powers of from 6 to 90 horses, an abstract of some of which was published in your Journal for 1840.

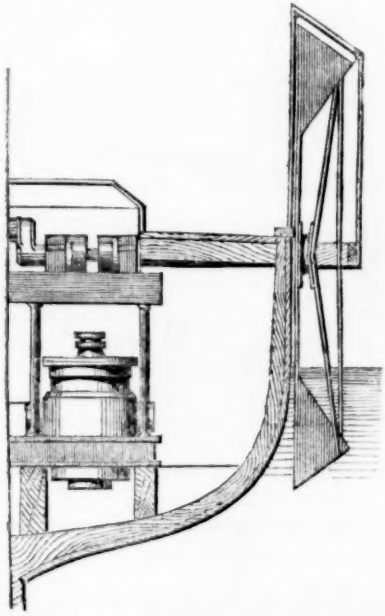


Fig. 5.—Improved Triangular System when the Vessel is Upright.

The following were the particulars of the "African" when tried in 1837, previous to her being tried in 1841:—

	Feet.	Inches.
Length between perpendiculars,	109	11
Extreme breadth,	24	10
Mean draught,	9	$4\frac{1}{2}$
Depth,	10	0

Nominal power of engines (by Maudslays and Field) 45 horses, or 90 horses together.

Number of strokes made by the engine per minute, 29 to 30.

Barometer gauge, 24 to $26\frac{3}{4}$ inches.

Area of immersed midship section, 150 square feet.

Mean diameter of the paddle wheels, 14·7.

Area of the immersed rectangular floats, on the cycloidal or Galloway system, twelve in number, 7 feet in length, and 1 foot 9 inches in breadth; thus presenting an area of from 57 to 60 square feet, being a ratio of 1 foot of float to 2·6 midship section.

When this trial was made in 1837, at the measured mile in Long Reach, her average speed of six trials each way was 9·174 statute miles per hour with her rectangular floats. Subsequently, she was employed for towing and other purposes, and had never undergone any other repairs than in her engines, and had never been in dry dock; her bottom was consequently foul and covered with green weeds, when tried with the trapezium floats in 1841.

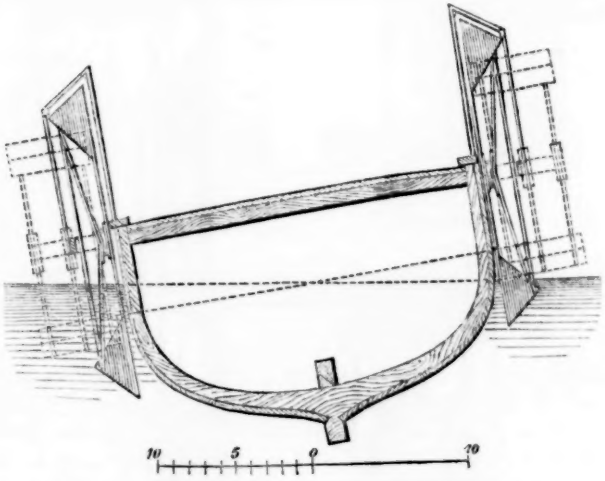


Fig. 6.—Improved Triangular System when the Vessel is Inclined.

Experiments on H. M. Steamer "African," with Trapezium Floats.

First Trial, April 14, 1841.

All the rectangular floats, twelve in number on each wheel, were removed, and twelve trapezium floats were fixed to the interior and middle rings of each wheel:

Thus making the area of the immersed floats 34 square feet.
Number of revolutions made by engines, $23\frac{1}{2}$ per minute.
Mean speed of vessel in statute miles, 9·1.
Mean diameter of wheels, 17 feet.

Second Trial, April 21, 1841.

Number of revolutions made by engines per minute, 23.
Speed in statute miles per hour, (weather very windy,) $8\frac{3}{4}$.

Third Trial—Area of Floats reduced 1 foot each, and reefed-up 4 inches.

Number of revolutions made by engines per minute, $25\frac{1}{2}$.
Speed of vessel in statute miles per hour, 9·022.

Fourth Trial, June 8, 1841.

Number of revolutions made by engines per minute, 25.
Speed of vessel in miles per hour, (weather windy,) 8·8.

Fifth Trial, June 9, 1841.—Immersed Float Surface reduced to 22 sq. ft. area, and reefed-up 11 inches; or reducing the diameter of the wheel 22 inches.

Number of revolutions made by engines per minute, $27\frac{1}{4}$.
Speed of vessel in statute miles per hour, 9·124.
The barometer stood at from 25 to 26 inches.

Which result was nearly equal to her former speed (viz. 9·174) in 1837, with rectangular floats of more than double the immersed area of the trapezium floats.

Experiments with Towing, as per accompanying Table.

In June, 1841, the "African" towed the "Numa" transport of 323 tons, at the rate of $5\frac{1}{2}$ statute miles per hour.

In July following, she towed H. M. steam frigate "Dee," of 704 tons, and 200-horse power, 5 statute miles per hour,—which was only 1·6 miles per hour less than her greatest speed when propelled by her own engines, or 6·6 miles per hour.

The official report, on the following page, only differs by half a mile between the towing powers of the "African," with her rectangular floats, in 1837, and the trapezium floats, in 1841; so that, considering that the area of the trapezium floats was merely adapted to propelling the "African" simply as regarded speed, these trials could hardly be taken as the criterion of their powers as applied to towing, when the areas should have been increased expressly for that purpose. But, comparing the whole of the experiments, when tried in still water under the most favorable circumstances, and when tried in the "African," under the unfavorable circumstances of foul bottom and difference of the powers of the engines, the conclusion is in favor of the trapezium floats. The truth of the principle is confirmed by Mr. Ewbank, and by the laws which govern the forms of the tails of fishes, the feet of aquatic birds, and the wings of birds and insects, whereby the means are so admirably suited to the ends; and the triangular form proposed by Mr. Ewbank for paddle floats entirely confirms the view I took of the subject in the years 1839 and 1840.

London, August 15, 1849.

"*African*," *Steam-Tug; Trials of her Towing Qualities with Mr. Rennie's Trapezium Wheels.*

(Tonnage, 323 tons new measurement. Power, 2×45 horse engines=90 horses' power.)

First Experiment.—*Towed the "Numa" Transport from Deptford to Greenwich.*

Date.	No. of Experiment.	Draft of water of Tug.	Dip.	Draft of vessel Towed.	Where tried.	Duration of Experiment.	Distance run.	Rate per hour	Revolutions.	Remarks.
		ft. in.	ft. in.	ft. in.		h. m.	Knots.			
June 24	1	F. 9 0 A. 9 10	3 0	F. 12 8 A. 14 1	Woolwich to Deptford.	0 34	4 1-5	7·4	27½	Without the Tow; two patent logs used.
"	2	"	"	"	Blackwall to Woolwich.	0 23	1 5-6	4·8	24	The 'Numa' in Tow; light wind ahead.
"	3	"	"	"	Barking to Gravesend.	1 50	7½	4·09	19 to 23	Pretty fresh breeze ahead in some of the reaches, which accounts for the difference of speed of engines.
June 25	4	—	"	—	Gravesend to Woolwich.	1 6	8	7·3	27	But little wind; returning without Tow.

Second Experiment.—*Towed the "Dee" Steam Frigate from Woolwich to Sheerness.*

Date.	No. of Experiment.	Draft of water of Tug.	Dip.	Draft of vessel towed.	Where tried.	Duration of Experiment.	Distance run.	Rate per hour	Revolutions.	Remarks.
		ft. in.	ft. in.	ft. in.		h. m.	Knots.			
July 7	1	F. 8 9½ A. 9 9	2 10	F. 8 9 A. 8 0	Barking to Sea Reach.	2 25	11·3	4·4	23 to 24	Wind W. S. W.; 'Dee' in tow; moderate breeze.
"	2	"	"	"	Sea Reach to the Nore; with 2d motion.	2 0	8·85	4·42	34 to 38	Strong breeze right aft, which assisted the tow materially; steam difficult to keep up at 38 revolutions; throttle valves half open; 2d motion in gear.
July 8	3	"	"	—	Lower part of Sea Reach to Barking.	3 15	22·1	6·8	27¼ to 28	Fresh breeze ahead and on the bow throughout the run; 2d motion not in gear.

Deflexion of Railway Bridges under the Passage of Heavy Bodies. By PROFESSOR WILLIS.*

Some time ago a commission, of which Prof. W. had the honor to be a member, was appointed by the Government to inquire into the application of iron to railways; and though he was not about to detail to them all the labors of that commission, he would give them some account of the results of a portion of its researches.

They had found it necessary to ascertain the effect which the passage of loads over iron railway bridges had in deflecting them. They had clearly ascertained the character of the effect a railway engine and tender would have upon an iron bridge when in a state of rest, but they did not know whether, when the train was in a state of motion, the deflexion would be greater or less. For the purpose of determining this interesting and important question, a temporary railroad, the bridge being represented by two iron bars, had been constructed in Portsmouth Dockyard, and so arranged that, by means of an inclined plane, any required degree of velocity could be attained by the carriage with which the experiments were conducted. With this apparatus a long and interesting series of experiments were made, the weight of the loads being varied, and the uniform result was that the statical deflexion (*i. e.* the deflexion caused by the carriage when at rest on the centre of the bars) was three or four times less than the deflexion caused when the carriage was in a state of motion. The apparatus which he exhibited to them that evening was on a much smaller scale than the Portsmouth one, for whilst the latter enabled them to pass a weight of from three to four tons over the bridge, the former only carried a weight of as many pounds.

As the object of the experimental philosopher was to eliminate all obstructing causes, they must begin their experiments on a small scale, so that it was necessary to employ a smaller apparatus, and also to obtain a different material to cast iron, and a material, too, that would give, by its greater delicacy of texture, closer results, and that would not display the curious phenomenon of "set." He had, therefore, in his more recent experiments, used bars of cast steel, and in order to do away with any irregular pressure of the carriage—for in the deflexion they sometimes found more pressure on the one bar than the other—he had used one bar instead of two.

The reverend professor here proceeded to give a description of the apparatus, which consisted of a railway, between twenty and thirty feet long, formed of deal planking, and having at one end an inclined plane with an altitude of about twenty feet. Upon this plane a movable break was fixed, so as to hold the carriage at any required height, and to insure accuracy in the starting point. The centre of the line of rail was occupied by the bridge, and the extreme end opposite the incline was so made as to open slightly outwards, so that springs fixed on either side the carriage might clasp the sides of the line and retard further motion, thus preventing the carriage from running off the line after passing the bridge. The carriage employed was merely a small model of a luggage wagon, the flanches

* From the London Mechanics' Magazine, for September, 1849.

of the wheels being made outwards instead of inwards, so as to clip the line along which they passed.

A long and interesting series of experiments was here performed, the velocity of the motion being considerably varied, the result invariably being that the deflexion of the bar was, during the motion of the carriage, triple the extent of the deflexion caused whilst the carriage merely rested upon the bar.

Mr. Willis now proceeded to observe that the weight of railway bridges was generally much greater than that of any load that passed over them, whilst his bar was much lighter than the load that had so greatly deflected it. An ingenious contrivance for strengthening the bar, by increasing the weight to be deflected with it, was then resorted to, which showed that the increase in the weight of the bridge had diminished the deflexion, although, the Professor observed, that to take this as a general principle would be wrong, for there were cases in which an increase in the weight of the bridge actually increased rather than diminished the deflexion. He was, however, happy to say that the very serious facts connected with the deflexion of iron railway bridges, the results of which he had that evening attempted to develope, did not exist in practice to so great an extent as in theory; and, indeed, they found that the deflexion was, in practice, so slight that it might be almost altogether neglected. This fact the Commission had established by actual experiments upon a bridge on a railway in Surrey.

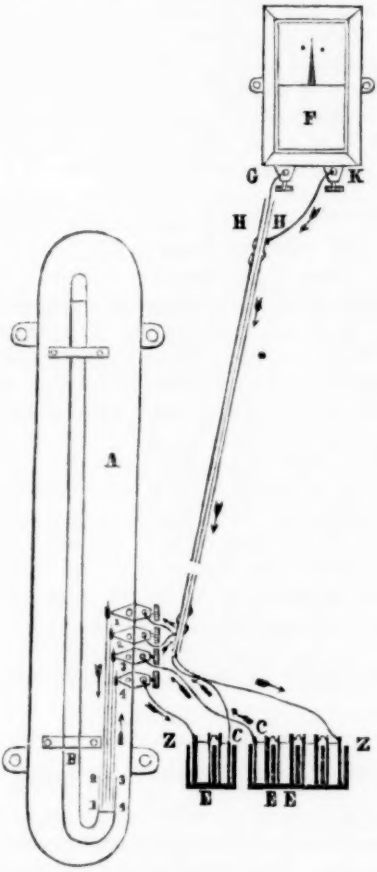
In conclusion, he might observe that some experiments had been made at Portsmouth, as to the advantage to be derived from curving bars upwards, which certainly diminished the centrifugal force, and consequently lessened the deflexion, but no practical results were elicited.

Preventing Explosions in Coal Mines. By Mr. Geo. Little.*

I lose not a moment in forwarding you a sketch of my apparatus for the prevention of explosions in mines, in order that those who are disposed may prove its efficacy. A, the ordinary barometer, which may be encased in an iron tube or box; 1, 2, 3, and 4, four adjustable platina wires, in connexion with four binding screws, and leading down into the glass tube, the wires 1 and 4 being the longest; E and EE, a small and large constant battery; F, the galvanometer; G, the insulated conducting wire; its leaden coating, H H. The action of the apparatus will be as follows:—On the sudden fall of the mercury in the tube, which happens when an accumulation of fire-damp is taking place, the mercury at B will rise and make contact between the wires 1 and 4, which will cause the electric current of the small battery to be brought into action, by the electricity passing from the copper, in the direction of the arrow, up through the wire W; thence onwards to the binding screw and wire G, returning by the binding screw K to the leaden tube, in the direction of the arrow, to the binding screw 1, onwards, by the platina wire, through the mercury and the wire 4, to the zinc end, thereby completing the circuit, and holding over the indicator to the right, thus giving notice that the gas is accumulating.

* From the London Mining Journal, No. 734.

Now, as the gas accumulates, the barometer will continue to fall, and, consequently, the mercury at B will rise still higher, until it comes into contact with the wires 2 and 3, when the larger battery will be immediately brought into action by the current passing from the copper, in the direction of the arrows, to the binding screw 3; thence by the wire and mercury to the wire and binding screw 2, and onwards by the leaden tube to the



binding screw K, returning through the wire G W; enters in the direction of the arrow to the zinc, completing the circuit in an opposite direction, and, overcoming the power of the small battery E, causes the indicator to pass over to the left, thereby giving notice of extreme danger. An alarm can be placed in the circuit if desirable, so as to obviate the necessity of watching. It is well known that a constant battery can be made to last eighteen months or two years without any attention. The cost of renewing the battery power once every two years will be about 12*s.* 6*d.*

Melton-crescent, Euston-square, Sept. 12, 1849.

Iron Roofing. *By* Mr. R. Turner.*

At the Liverpool Polytechnic Society, Mr. R. Turner, of Dublin, furnished the following interesting particulars of a new galvanized iron roofing and other works of a railway station at Liverpool, which he is now constructing. The roof covers an area of 6140 square yards, being about 360 feet in length, and 153 feet 6 inches in width. There are no intermediate columns, but this great space is spanned over by one stupendous arch, rising in a segment of a circle to a central height of 30 feet from the spring or cord. The roof consists of 17 curved girders of wrought iron, resting at one side on the walls of the offices, and at the other upon cast iron columns of the Doric order, connected by ornamental arches in perforated iron. These girders are trussed vertically by a series of radiating struts, acted upon by tie-bars, connected with the extremities of the girders; and they are trussed horizontally by a series of purlins and diagonal rods, thus forming one rigid piece of framing from end to end. Upon this framing will be laid plates of galvanized corrugated iron, and three ranges of plate glass, in sheets about 12 feet 6 inches in length, and of great thickness, extending the whole length of the roof. In consequence of the great extent of surface exposed to the variations of temperature, provision has been made for expansion and contraction of the iron without injury to its bearings. The roof, when finished, will weigh about 700 tons. The whole of the work, with the exception of the cast iron columns and ornamental arches, is of wrought iron. The iron columns upon which the roof rests, on the south side of the yard, are 2 feet 3 inches in diameter at their bases. Six of the girders are fixed; and having struck the centres under three of these girders, it was found that in not one of them was there the least perceptible deflexion. Mr. Turner produced specimens of the various parts of the ironwork employed in the roof in question, and explained the manner in which they were applied, so as to make a perfect whole. Though these samples are very massive, it was stated that the huge roof though of great strength, would appear to the eye as light as a cobweb.

Use of Small Engines on Railways.†

The traffic of branch lines in general, if not, too, of some main ones, it would appear, may ere long be altogether conducted by light engines, at great saving of expense. Experiments have occasionally been recorded in the Builder that seemed to promise fairly for such a result, which further experience only appears to confirm. The Railway Times of 13th October, gives the particulars of a personal examination of the doings and dimensions of one of these little, active, and even singularly powerful agents, built by Messrs. England & Co., of the Hatcham Ironworks, and at present at work on the Bow branch of the Blackwall line. It whirls a train of seven of the heavy Blackwall carriages, equal, it is said, to ten of the carriages in general use on other railways, up an incline of 1 in 100, at a

* From the London Mining Journal, No. 734.
† From the London Builder, No. 350.

speed of 35 miles an hour, starting as freely, and getting into speed as readily, as any other engine. The dimensions of this "*Pigmy Giant*," as it is named, are as follows: Cylinders, 8 inches diameter; stroke, 12 inches; driving wheels, 4 feet 6 inches; four carrying wheels, 3 feet diameter; 80 tubes, $1\frac{5}{8}$ inches diameter, 11 feet 4 inches long. The engine and tender are constructed on the same frame, with six wheels, and she is capable of carrying coke and water in her tender sufficient for a journey of 30 or 40 miles. The consumption of coke is less than 5 lbs. a mile, producing, nevertheless, an immense quantity of steam. The weight of the whole engine, when in full working order, is about 10 tons. The centre of gravity being very low, there is no oscillation, even at a very high velocity. The day's work on the Bow branch is a run of about 200 miles.

Report on the Oxidation of Rails in and out of use, Determining the Loss by Abrasion. By Mr. R. Mallet.*

The conclusions at which Mr. Mallet has arrived are the following: The top surface of a railway bar in use is constantly preserved in a state of perfect cleanliness, freedom from oxidation and polish; while the remainder of the bar is rough coated originally with black oxide, and soon after with red rust (peroxide and basic salts). Not only is every metal electro-positive to its own oxides, but, as established in the second Report on the action of air and water on iron, the polished portion of a mass of metal partially polished and partially rough is primarily corroded on the rough portion. Hence a railway bar, while in use, is constantly preserved from rusting by the presence of its polished top surface. Such polished surface has no existence on the rail out of use. The upper surface of the rail in use is rapidly condensed and hardened by the rolling of the traffic over it; and it is also shown in the above Report that, all other circumstances being the same, the rate of corrosion of any iron depends upon its density, and is less in proportion as this is rendered greater by mechanical means. As every metal is positive to its own oxides, the adherent coat of rust upon iron, while it remains, powerfully promotes the corrosion of the metal beneath, and this in a greater degree in proportion as the rust adherent is of greater antiquity.

It has been shown that the rust produced by air and water, which at first contains but little per-oxide, continues to change slowly, and, becoming more and more per-oxidized, becomes more and more electro-negative to its own base. Now, the rust upon a railway bar out of use continues always to adhere to it, and thus to promote and accelerate its corrosion; while the rust formed upon a railway bar in use is perpetually shaken off by vibration, and thus this source of increased chemical action is removed.

To recapitulate, railway bars forming part of a long line, whether in or out of use, corrode less for equal surfaces than a short piece of the same iron similarly exposed. Rails in use do corrode less than those out of use. This difference is constantly decreasing with the lapse of time. The absolute amount of corrosion is a source of destruction of the rail greatly inferior to that due to traffic. It is highly probable that the electrical and

* From the London Athenæum, for September, 1849.

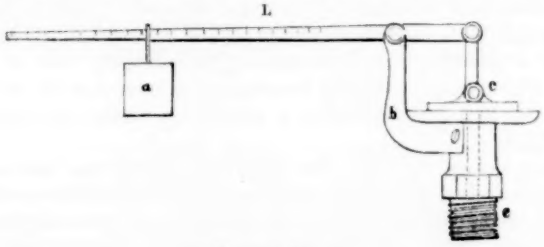
magnetic forces developed in the rails by terrestrial magnetism, and by rolling traffic, react in some way upon the chemical forces concerned in their corrosion; and that, therefore, the direction of lines of railway in azimuth is not wholly indifferent as respects the question of the durability of rails.

The author concludes with two practical suggestions, deducible from the information obtained:—1st, Of whatever quality iron rails are rolled, that they should be subjected, prior to use, to an uniform course of hammer-hardening all over the top surface and sides of the rails; and, 2dly, that all railway bars, before being laid down, should, after having been gauged and strengthened, be heated to about 400° Fahrenheit, and then coated with boiled coal tar. This has been proved to last more than four years, as a coating perfectly impervious to corrosive action, while constantly exposed to traffic.

An Improved Pressure Indicator. *By* Mr. John P. Fraser.*

As many engineers have been much annoyed by the uncertain action of their pressure indicators, (manometers and piston indicators,) the first requiring a correction for the temperature of the air, and the last from friction and unequal expansion, I take the liberty of sending a sketch of one that I have constructed, which, as far as I have used it, seems to answer the purpose well.

Clement Désormes showed that, when steam under high pressure escapes through a pin hole in a plate, and a flat disk is brought close to this plate, the plate and disk are made to adhere. This, then, is the principle on which I have made my pressure indicator. The cause of this I need not here explain, as your readers, if you be kind enough to insert this communication in your valuable Magazine, will, I think, easily understand it.



Description.

a is a weight, which, by sliding outwards or inwards on the arm of L, (a lever of the first order, supported by the prop *b*,) an equilibrium may be obtained, and the index then read.

c is a movable disk, linked to the end of the lever L; *d* is a plate, having a hole through it and the screwed part, *e*, which is made to fit the top of a gauge glass attached to any convenient part of a boiler or steam chest.

When steam is allowed to rush through the hole in the plate *d*, the reaction produced by the pressure of the atmosphere causes the disk *c* to

* From the London Mechanics' Magazine, for October, 1849.

adhere to the plate. The relative sizes of the disk *c*, and the hole in the plate *d*, together with the weight required to separate the two (that is, the disk and plate) when the steam is allowed to act upon the instrument, determine the amount of pressure sustained by the boiler.

Drawing Office, Swindon Works, Oct. 8, 1849.

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*Vastness of Railway Works.**

The great Pyramid of Egypt was, according to Diodorus Siculus, constructed by 300,000—according to Heredotus, by 100,000 men; it required for its execution twenty years, and the labor expended on it has been estimated as equivalent to lifting 15,733,000,000 (fifteen thousand seven hundred and thirty-three millions) of cubic feet of stone, one foot high. Now, in the same measure, if the labor expended in constructing the *southern* division only of the present London and North Western Railway, be reduced to one common denomination, the result is 25,000,000,000 (twenty-five thousand millions) of cubic feet of similar material lifted to the same height, being 9,267,000,000 (nine thousand two hundred and sixty-seven millions) of cubic feet *more* than was lifted for the Pyramids, and yet the English work was performed by about 20,000 men only, in less than five years.—*Sir F. Head.*

AMERICAN PATENTS.

List of American Patents which issued in the Month of May, 1849, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner in the U. S. Patent Office.*

1. For a *Locomotive with the Driving Axle above the Boiler;* Richard H. Emerson, Portland, Cumberland county, Maine, May 1.

The patentee says,—"My improvement consists in the manner in which the axle of the driving wheels, the boiler, and the bearing and running truck frames, and their wheels, are disposed or arranged with respect to each other."

Claim.—"What I claim, is the above described mode of arranging the boiler, the axle of the driving wheels, and truck frames of the supporting wheels, whereby I am enabled to produce an engine combining great speed and safety."

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2. For an *Improvement in Tables for Ships' Cabins;* William N. Boggs, Southborough, Worcester county, Massachusetts, May 1.

The patentee says,—"My improved table is intended especially for the use of sea-going vessels, the particular object of my invention being to always preserve the top surface of the table horizontal in a transverse direction, during the motions of the vessel produced by the sea or otherwise."

* From the London Builder, No. 352.

Claim.—"The principal feature of my invention, and that claimed by me, is the above described peculiar arrangement of, or manner of arranging, the hinges or rocking or turning bearings of the table top, together with that of applying the pendulum apparatus, by which the level of the top board is preserved under the transverse motions of the vessel; the said arrangement consisting, first, in placing the hinges or turning bearings nearer to that edge of a table at which a person is to sit than to the opposite edge, as shown in the drawings. Second, In applying the pendulum apparatus to the opposite side or part of the table, as described, whereby it is caused, when the pendulum is vibrated, to act against, or raise and depress, and give greater motion to, that side or part of the table top which is opposite to that at which the person sits; the effect of said arrangement, when a vessel is in the act of rolling, being not only to render the table free from inconvenient action where a person sits to it, but to impart to it stability under weight or pressure applied to it near the edge at which the person so sits or is placed. And I also claim the above described mode of making a table, viz., a combination of two top boards, B B′, a supporting frame, and one or more sets of pendulum apparatus, whether made and applied as exhibited in figures 1, 2, 3, and 4, or as represented in figure 5, and as above explained; the whole being constructed so as to operate essentially as specified."

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3. For an *Improvement in Calculating Machines;* William M. Haines, Rochester, Monroe county, New York, May 1.

Claim.—"What I claim, is the combination of the stationary circle A with the circles C and D, fig. 1, and with circles O and 6, fig. 2, in the manner and for the purpose substantially as described. I also claim the combination of the inner circle C, fig. 1, with the ratchet circle *b*, fig. 2, in such a manner as to move circle 6, fig. 2, one number in one direction for every revolution of circle C in a contrary direction, for the purpose of carrying one to the outer square hole F for every hundred added by moving circle C. I also claim the combination of the pinion 8 with the movable circle D, and the roller 9, screw 10, and wheel Y, and bevel 7, whereby, when the circle D is moved round, the roller 9 and the minor circle plate of E are moved also in conjunction with the circle C, for the purposes set forth.

"I claim the combination, in the manner specified in the above claims, of the mechanical devices, or their equivalents, herein set forth, along with the circles and circle, stationary and fixed, having figures on the same, to produce the arithmetical results substantially as herein described."

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4. For an *Improvement in Printing Paper Hangings;* William M. Shaw, (as joint inventor with, and assignee of, Ezra Gould,) Newark, New Jersey, May 1.

The patentees say,—"1st, The nature of our invention consists in providing a drum, with an eccentric rail or flanch on the same, on which is placed, or connected with it, the slide of a horizontal shaft, for the purpose of giving an intermittent horizontal motion to the frames in which the

blocks are secured that make the impressions on the paper; also in providing a vibrating reciprocating catch bar, to take the paper, when printed, from under the block, drawing it forward on a transverse table, thus making the machine self-feeding.

"2d, The nature of our invention further consists in attaching the platens of the block plates to standards connected to the frames in which the said platens are placed by coiled springs, which spring up both the blocks and platens from the paper after the impression is made.

"3d, It further consists in providing spring pistons, passing vertically through guide eyes attached to suspended jointed arms, to be operated by cams on an upper revolving shaft, the which cams press down regularly the spring pistons on the top of the platens, to make one block impress the paper with color, and the other to receive color from a color sieve."

Claim.—"What we claim as our invention, is the combination of the platens with the block frames by means of the coiled springs, to keep up the blocks from the face of the table, and to allow the said blocks to be pressed down on the paper and color sieves, substantially as described.

"We also claim the arrangement of the cams on the revolving shaft, in combination with the spring pistons in the guide eyes, to press down the platens during the intermission of the motion of the block frames, as described.

"We also claim the combination of the catch bars with the rocker, and the connecting rod and oscillating angular lever, and the arm connected with the block frame, to take the printed paper from under the block, and bring forward the unprinted paper to receive the next impression, substantially as described."

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5. For an *Improvement in Trusses;* Gilead A. Smith, assignee of Abijah Smith, City of New York, May 1.

Claim.—"What I claim as my invention, is the mode of applying a truss or supporter, constructed substantially as described; and I also claim making the metallic or spring portion of the truss or supporter, to be applied perpendicularly between the legs, of round or oval wire, in the manner and for the purpose described."

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6. For an *Improvement in Artificial Teeth;* Henry Lawrence, Philadelphia, Pennsylvania, May 1.

Claim.—"What I claim as my invention, is making or preparing the tooth with an aperture passing through it, and terminating with a countersink, or suitable bearing to receive or support the head of the screw, as herein set forth, as a new article of manufacture."

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7. For an *Improvement in Education Tables;* Edwin Allen, Windham, Windham county, Connecticut, May 1.

The patentee says,—"The nature of my invention consists in taking any piece of hard board or other stuff, of suitable size and thickness, and making grooves or channels in any required number in or on its face, and running in any required direction, the same being of any required size and

shape, to receive the sliding types, which are made of solid blocks, with buttons on their lower ends for sliding or moving within the channels, and preventing them being lost or getting off the table."

Claim.—"What I claim as my invention, is the manner in which I make my education tables, substantially as set forth, of two sets or series of grooves, one for the fount, the other for the operations of calculation, in combination with sliding types, the grooves and types so constructed as to prevent the types from being lifted or falling out, and the grooves so arranged that the types may pass by each other as set forth."

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8. For a *Self-Regulating Filtering Diaphragm;* William H. Jennison, City of New York, May 1.

The patentee says,—"The nature of my invention consists, 1st, in making a filtering diaphragm to turn on a journal, and provided with a key or handle by which it can be turned, when this is combined with, and so arranged within, an outer shell or case of a spheroidal form, or otherwise so formed as to admit of a free passage of the water or other fluid when the diaphragm is turned longitudinally, but which will have to pass through the filtering medium when the diaphragm is placed transversely, by means of which combination and arrangement either filtered or unfiltered water may be drawn, and by means of which, also, the filtering medium can be reversed within the outer case for the purpose of cleaning.

"The second part of my invention consists in making the filtering diaphragm of one or two movable perforated plates, held within a casing which admits of their being moved towards one another to a certain and definite extent, when this is combined with an interposed filtering medium, composed wholly or partly of sponge or other elastic medium.

"The third part of my invention relates to the mode of packing the outer periphery of the filtering diaphragm, and consists in making two grooves in the said periphery, one on each side of the axis of rotation, and fitting to each groove an annulus of vulcanized India rubber.

"And the last part of my invention relates to the packing of the journal which passes through the outer shell or casing, or for other packing, and consists in filling a metallic case with the appropriate compound of India rubber while the said compound is in a soft and semi-fluid state, leaving a hole in the centre, such as will admit of inserting the journal or other article to be packed, and then baking the said rubber after the usual or any other mode of treating what is called vulcanized rubber; after being properly baked the metal case is soldered or otherwise secured to the outer shell or casing of the filter."

Claim.—"What I claim as my invention, is the combination of a filtering diaphragm composed of elastic media and movable disks, substantially as described, when combined with an outer shell or case within which it can rotate, either to force the liquid to pass through the filtering medium, or to pass by the side thereof, and issue without being filtered, the stem or journal of the diaphragm being passed through a stuffing box attached to the outer case, as described, or in any other manner essentially the same.

"I also claim making the filtering medium with one or both perforated disks, movable, as described, when combined with an elastic filtering medium, substantially as described."

9. For an *Improved Right or Left-Hand Lock;* L. R. Livingston, J. J. Roggen, and Calvin Adams, Pittsburg, Pennsylvania, May 1.

The patentees say,—"The principle of our invention is that of constructing a lock in such a manner as to allow of its being used equally well on a door opening either to the right or the left hand, and of being in both cases locked and unlocked by the key inserted in the keyhole with its wing downwards."

Claim.—"What we claim as our invention, is the constructing a door lock in such a manner as to allow of its being used equally well on a door opening either to the right or the left hand, by means of a keyhole that will admit a key within the lock in reversed positions, in combination with such an arrangement of the movements of the lock as will enable the key to operate the same tumbler and bolt in whichever position it may be inserted within the keyhole."

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10. For an *Improved Gold Washer;* Lewis Jennings, City of New York, May 1.

The patentee says,—"The principle or character of my invention, and that which distinguishes it from all other things before known, consists in the employment of a vertical tube or chamber through which a current of water descends, which tube or chamber is connected with a second tube or chamber containing gold and foreign matters, there being a third or an outer vessel or chamber, with an inclined or curved bottom, so formed and located as to leave a space between it and the lower end of the first and second tubes or chambers, so that the current of water which passes down the first tube or chamber will escape below the lower edge thereof, and move towards the space between the second and the outer casing, so that the gold and all the foreign matters are in still water between the first and second, where, by gravity, they descend without interruption, until they reach the outward current of water from the first tube or chamber, which, acting on the gold and the foreign matters, has sufficient force to separate, by washing, the impurities from the particles of gold, the latter falling by their superior gravity into a cup-formed receptacle below the first tube, whilst the foreign matters, which are of less specific gravity, are carried up by the current, and are discharged over the upper edge of the outer casing."

Claim.—"What I claim as my invention, is the employment of a chamber or tube, through which a current of water is to flow, when this is combined with a second tube or chamber, which receives the gold and earthy matter, and the third or outer chamber, provided with a bottom so far below the partitions forming the first and second tubes or chambers, as to leave a space for the passage of water from the first tube or chamber to the discharge chamber or outer casing, in the manner and for the purpose specified."

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11. For an *Improvement in Churn Dashers;* Josiah A. Gridley, Southampton, Hampshire county, Massachusetts, May 1.

The patentee says,—"My invention consists in so constructing a churn

dasher as to force air under the cream in the churn, and diffuse the same through it without the employment of valves or other movable parts in the dasher, which are liable to get out of order; and also saving the expense of forming the handle of the dasher hollow."

Claim.—"What I claim as new, is the above described dasher, made concave, with openings around it for dispersing the air throughout the cream without the use of valves, constructed and arranged substantially in the manner set forth."

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12. For an *Improvement in Machinery for Making Mats, &c.;* Daniel Hodgman and Amos D. Wyckoff, City of New York, May 1.

Claim.—"What we claim as our invention, is a comb composed of a series of divisions or cells, either entirely separated or otherwise, in combination with the pistons and graduating screws, in manner and for the purpose as described."

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13. For an *Improved Method of Making Wire Strengthened Spoons;* Wm. Mix, Prospect, New Haven county, Connecticut, May 1.

Claim.—"What I claim as my invention, is the mode described of making spoons, by first casting them upon a draw tap, with the ends of the spoon handles longer than ordinary, and then, having inserted a wire, swedging the handles to the required and proper shape, completely covering and concealing the inserted wire."

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14. For an *Improvement in Valve Seats, &c., for Water Mains;* Theodore R. Scowden, Cincinnati, Ohio, May 1.

The patentee says,—"The nature of my invention consists in so constructing a stop valve for water mains, in all its mechanical arrangements one with another, that, be the water main large or small, the seats can be adjusted to the valve, when wear and tear render such adjustment necessary, without being under the necessity of removing the same from its permanent location in the line of the water pipes."

Claim.—"What I claim, is arranging and combining, substantially as described and represented, or in any analogous manner, the several parts involved in the construction of stop valves for water mains, viz., the chamber, the movable pipe heads, the valve seats, the system of lugs, bolts, and screw nuts, the soft metal and the valve, so that, buried as they must be beneath the frost line in the ground, they can be adjusted in the matter of their valves and valve seats without being removed from their permanent location in the line of the water main."

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15. For an *Improvement in Cast Iron Car Wheels;* Isaac Van Kuran, Rochester, New York, May 1.

The patentee says,—"The nature of my invention and improvement consists in casting railroad car wheels with a rim of the form of a semi-ellipsis, and of an oblate spheroidal form at the centre or hub part, with braces on either side, in such a manner as to strengthen the same, remove

all danger of breaking from cooling, and cause the pressure and strain exerted on the hub to be more equally divided over the several parts of the wheel than in the ordinary form of car wheels now in use."

Claim.—"What I claim as my invention, is casting railroad car wheels with a rim of the form of a semi-ellipsis, and of an oblate spheroid near the centre, the hub being cast solid with the same, with braces of the form of cima reversa and cima-rectas formed in the valley between the rim and oblate spheroidal shell surrounding the hub, arranged in contrary directions on either side, in the manner and for the purpose set forth."

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16. For an *Improvement in Easy Chairs;* Aug. Clark, City of New York, May 1.

The patentee says,—"The nature of my improvement consists in the combining and adapting to the ordinary chair a sliding seat board, so as to draw out at the back of the chair, to expose the permanent seat; a draw slide board, drawing out from the side of the chair, from the under side of the permanent seat board of the chair, for the purpose of covering the chamber box; and a sliding chamber box, arranged in such a manner as to place the convenience of the chair within the reach of the patient at all times, while at the same time, when not in use, preventing the escape of all unpleasant effects from its use in the room."

Claim.—"What I claim, is the employment of the sliding seat board, draw slide for covering the mouth of the chamber box, and the sliding chamber box, in combination with, and as adapted to, an easy or sick room chair, so as to make a portable close-chambered easy chair for the sick room, in form and manner as described."

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17. For an *Improved Method of Turning the Drill in Rock Drilling Machines;* Jesse N. Bolles, Providence, Rhode Island, and Henry G. Knight, Boston, Massachusetts, May 1.

Claim.—"We claim the combination of the slotted plate and the friction clasp and its arm, as applied to the drill shaft and main frame, and made to operate in connexion with the elevating jaws, substantially in the manner and for the purpose of rotating the drill as specified."

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18. For an *Improvement in the Preparation of Flour for Bread Making;* John Fowler, City of New York, assignee of Henry Jones, Bristol, England, May 1; (anté dated in England March 13, 1845.)

The patentee says,—"The nature of my invention consists in the adding to a certain weight of flour such quantities of alkalines and acids, sugar and salt, as shall, by the addition of water only, enable such prepared flour to be manufactured into bread, &c., without the use of fermenting matter."

Claim.—"What I claim, is mixing both the acid and alkali with the flour in the dry state, sugar and salt being added or not at will, in the manner and for the purpose herein set forth, as a new article of manufacture."

19. For *Improvements for Jointing and Cutting Staves;* Charles Mowry, Elbridge, Onondaga county, New York, May 1.

Claim.—"What I claim as my invention, is the combination of the main (stave-cutting) knife with the two jointing knives, and with feeding apparatus, in such a manner that the stave will be jointed immediately before they are cut from the block, and then the block moved forwards into the proper position to be again acted upon by the jointing and stave-cutting knives, in the manner set forth."

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20. For an *Improvement in Electric Telegraphs;* Samuel F. B. Morse, Poughkeepsie, Dutchess county, New York, May 1.

The patentee says,—"The nature of my invention consists, 1st, in the application of the decomposing effects of electricity, produced from any known generator of electricity, to the marking of the signs for numerals, or letters, or words, or sentences, invented and arranged by me, and secured by patent bearing date June 20th, 1840, re-issued January 15th, 1846, and again re-issued June 13th, 1848, or their equivalents, through a single circuit of electrical conductors. 2d, In the mode of applying this decomposition, and the machinery for that purpose. 3d, In the application of the bleaching qualities of electricity to the printing of any desired characters."

Claim.—"What I claim as of my own invention and improvement, is, 1st, the use of a single circuit of conductors for the marking of my telegraphic signs, already patented, for numerals, letters, words, or sentences, by means of the decomposing, coloring, or bleaching effects of electricity, acting upon any known salts that leave a mark as the result of the said decomposition, upon paper, cloth, metals, or other convenient and known markable material.

"2d, I also claim the combination of machinery as described, by which any two metallic points, or other known conducting substance, broken parts of an electric or galvanic circuit, having the chemically prepared material in contact with and between them, may be used for the purpose of marking my telegraphic characters, already patented in letters patent dated 20th of June, 1840, in the first re-issue, 15th January, 1846, and second re-issue, 13th June, 1848."

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21. For an *Improvement in Corn Shellers;* David O. Prouty, Philadelphia, Pennsylvania, and Ezra Whitman, Baltimore, Maryland, May 29.

The patentees say,—"The first of our improvements consists in cutting out or beveling that portion of space on each side of the driving wheel and pinion, between the teeth on the pinion attached to the beveled wheels, and those on the driving wheel operating the pinion, in such a manner as to present a sharp edge between the teeth of the pinion and the driving wheel, instead of a square bed or plane surface.

"The second improvement consists in making the bevel on the beveled wheels concave, in such a manner that the concave surface so made shall partially enclose or come in contact with a much larger portion of the ears of corn as they pass through the machine, than would be with the ordinary

straight bevel now in use, and so that the outside circumference of the concave may operate as a kind of flanch, which, from its shape, will keep the ears of corn more firmly in contact with the stripping teeth on the sides of the driving wheel.

"The third improvement consists in the combination with, and attachment thereto, of a separator made of an endless belt of slats, operated by a band passing over a pulley attached or fastened upon the shaft of the driving wheel of the shelling machine, thence over a pulley fastened to the end of the shaft of the cylinder operating the endless belt of slats."

Claim.—"What we claim as new, is, 1st, the manner in which we cut out, and bevel off, the spaces between the teeth of the driving wheel and pinion, at the points *a a* in the drawing, so as to present a sharp edge, instead of a plane surface or bed, between the teeth. 2d, We claim the combination of the toothed wheel with the beveled or curved cylinder, arranged in the manner and for the purpose described."

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22. For an *Improvement in Sausage Machines;* Thomas Lockett, Warren county, Georgia, May 8.

The patentee says,—"The nature of my invention consists in constructing a hollow conoid, having a tube or nozzle on its apex, and a solid conoid, which is made to turn within the same, by the action of which the meat is minced or ground, and the sausage stuffed, at one operation."

Claim.—"What I claim as my invention, is the nozzle for stuffing the sausages, in combination with the hollow and solid conoids for grinding or mincing the meat, whether the same are arranged as described, or in any other substantially similar manner, by which the processes of stuffing and grinding can be simultaneously performed at one operation."

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23. For an *Improvement in Broom Brushes;* Agdalena S. Goodman, Duval county, Florida, May 8.

Claim.—"What I claim as my improvement and discovery, is the application and adaptation of the branches of the cabbage palmetto tree to the manufacture of brooms and brushes, (the handles being a portion of the same,) as described."

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24. For an *Improvement in Spring Rake Teeth;* Lyman Baker, Newbury, Merrimack county, New Hampshire, May 8.

The patentee says,—"My invention is intended to overcome the difficulties which are experienced in the mode of applying or affixing a spring tooth to a rake head, which is described and claimed in letters patent granted on the 14th day of March, 1846, to Seneca Ladd."

Claim.—"What I claim as my invention, is my improved mode of applying each tooth to the rake head: that is, I claim the combination of the spring socket, spring, and tooth, as arranged, constructed, and applied together, and to the rake head, as specified."

25. For an *Improvement in Trusses;* Lewis A. Hall, Newark, Essex county, New Jersey, May 8.

Claim.—"What I claim as my invention, is two rods of metal, of a proper size and shape, and meeting under the pereneum when in use, in combination with the metallic spiral spring or springs, or other analogous device."

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26. For an *Improvement in Washing Machines;* Sylvester Munson and William H. Pratt, Tremont, Tazewell county, Illinois, May 8.

Claim.—"What we claim as new, is, 1st, the combination of the lever, alternating rod, and jointed rods, with the dashers and wash-boxes, whereby two different lots of clothes, in two distinct wash-boxes, may be cleansed at the same time, by the action of two separate dashers operated by one lever.

"2d, We claim the combination of the wells and plungers with the wash-boxes, in the manner and for the purpose described."

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27. For an *Improved Self-Acting Railroad Switch;* Lucius B. Woods, Bradford, Merrimack county, New Hampshire, May 8.

The patentee says,—"The nature of this invention consists in arranging in front of the switch a traversing lever or bar, moving on a pin at its centre, and attaching to the end of the same a horizontal rod, running parallel with the turnout and main tracks, and connected to vibrating plates moving on pieces at the lower end, having levers connected to the same, and springs arranged on either side, and providing the rods arranged parallel with the main track with a pin or track rising from its upper surface, and passing through an oblique slot formed in an oblong plate secured to the end of a beam attached to the vibrating end of the switch, and through a slot parallel with the track, formed in a stationary oblong plate, in such a manner as to enable the engineer to move said switch to connect with the track on which the locomotive is desired to run, by simply moving a lever and causing a horizontal bar to strike the levers attached to the vibrating plates as it passes the same, and move said plates, and the part attached to the same, sufficiently far to produce the desired result."

Claim.—"What I claim as my invention, is the combination and arrangement of the traversing bar or lever, horizontal connecting rods, oblong plates, containing straight and oblique slots, in which the pin or cog rising from the connecting rod next the main track moves; transverse curved bar secured to the oblong plate containing the oblique slot, and to the vibrating ends of the switch; vibrating plates, having cogs from the upper parts, levers and springs, and horizontal bar, on the locomotive, operated as before stated for moving the ends of the switch either next the end of the rails of the main track, or turnout track, at the option of the engineer or other person to whom the duty is assigned, as set forth."

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28. For *Improved Lugs and Links for Connecting Pipes;* Chapman Warner, Louisville, Kentucky, May 8.

Claim.—"I claim the hooked form of the horns B B, and the wedge-like

form of the horns C C, by which the links or hasps, when applied to the said horns, are made to perform, in a speedy and cheap way, the work of screw bolts in making a tight joint, as described."

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29. For a *Method of Operating Railway Switches;* W. C. Hicks, Rutland, Rutland county, Vermont, May 8.

The patentee says,—"The nature of this invention consists in arranging between the rails of the double track a series of notched levers, sliding plates, cords, pulleys, and weights, and other attachments, so combined in relation to each other, and connected to the switch in such a manner, as to cause a projection or cam on the locomotive to operate the levers when the switch is out of position, and cause said switch to assume its proper position with the track before the locomotive reaches the same."

Claim.—"What I claim as my invention, is the arrangement and combination of the notched lever D G, slotted sliding plates, blocks or keys attached to the levers G by the pins, and chains, pulleys, and weights, operated by a cam or projection on the under part of the locomotive, in the manner and for the purpose set forth."

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30. For an *Improvement in Brewing and Preserving Alcoholic Drinks;* John Hopkins, Brownsville, Washington county, Pennsylvania, May 8.

The patentee says,—The nature of my discovery consists in the preparation of wood, by reducing it into a state of fine division, or of an extract of wood, either of which I employ in various ways, but chiefly in the manufacture and refinement of fermented and unfermented liquors, for the purpose of counteracting the tendency which they have to acetous fermentation, and to correct and improve their flavor."

Claim.—"What I claim as my discovery, is the preparation and employment of oak, or other woods possessing similar chemical properties, or an extract of such woods, as described, as a substitute for hops, in brewing, distilling, and yeast-making, to refine and improve the flavor of spirituous liquors, as a counteractive of acetous fermentation generally in wines and other fermented liquors, in syrups, in vegetable extracts, and other unfermented liquids, and to correct and improve the flavor of stale wines, cider, or beer."

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31. For an *Improvement in Daguerreotype Apparatus for Gilding Plates;* W. & W. H. Lewis, City of New York, May 8.

Claim.—"What we claim as new, is the application of the frame, constructed with points to convey the plate supported by a movable standard, on a triangular bed, having screws, for the purpose of adjusting the frame and Daguerreotype plate to a level, while gilding or otherwise operating on the same, substantially as described and shown."

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32. For an *Improvement in Saw Mills;* Lemuel Hedge, City of New York, May 8.

The patentee says,—"My invention consists of a saw formed of a plate

of steel, of suitable length, thickness, and width, with the ends joined together, forming a hoop, with saw teeth properly formed and set, on one edge of the hoop, which hoop is passed around two pulleys or cylinders revolving in suitable boxes, and separated from each other a sufficient distance to cause the hoop to become straightened in the parts *c* and *d*, and sufficiently strained by means of two screws *d'* and *a'*."

Claim.—"What I claim as my invention, is the means described, to preserve, increase, and regulate the tension of the working portion of the saw, when at work, viz., the application of the driving power to the lower pulley when the saw is designed to work in its downward motion, and the application of the break to the upper pulley."

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33. For an *Improvement in Bedsteads for Invalids and others;* Francis M. Webster, Newport, Campbell county, Kentucky, May 8.

The patentee says,—"My invention consists of a bedstead or lounge for grown persons, or crib for children, so constructed that the part of it on which the bed rests is suspended with cords, iron rods, or otherwise, and can be moved to and fro, with an oscillating and an undulating motion, either from side to side or from head to foot."

Claim.—"What I claim as my invention, is, 1st, the setting of the posts in such a manner as to admit of the swinging of the suspended frame, either lengthwise or crosswise of the bed.

"2d, I claim guide boards, worked by straps or otherwise, for giving direction to the motion of the suspended frame.

"3d, I claim the application of the springs to support the guide boards in their places during the operation of swinging."

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34. For an *Improvement in Destroying Weevil in Grain;* William Watson, Chicago, Cook county, Illinois, May 8.

The patentee says,—"My invention consists of a hollow metallic prism, of three or more sides, revolving in a trough, and capable of being heated by steam introduced into its interior through its hollow axis, each side being provided with a series of oblique adjustable cells, for the purpose of subjecting successive small portions of the grain repeatedly to the alternate action of heat and concussion, by elevating it from the bottom of the trough to the top of the prism, and thence projecting it down again into the bottom of the trough, to a point slightly in advance of that whence it was taken, repeating this operation until the grain is moved along from the end of the trough at which it is admitted to that at which it is discharged."

Claim.—"What I claim as my invention, is the application of the combined action of heat and concussion to grain and other seeds, for the destruction of weevil and other insects, and the eggs and larvæ thereof infesting the same, and separating other foreign matter therefrom, by means of a hollow prism, heated from its interior and turning in a trough, the prism being surrounded by adjustable cells attached obliquely across its sides; the whole being arranged and operated in the manner and for the purposes set forth."

35. For an *Improvement in Apparatus for Spooling Yarn;* Geo. H. Dodge, Attleborough, Bristol county, Massachusetts, May 8.

Claim.—"What I claim as my invention, is the arrangement or arranging of the point or nose of the spindle within a short distance, (say about one inch, or half an inch, or nearer if possible,) from the yarn-guide which is directly over it, and (that is, in combination with) so applying the spindle to its supporting rail, by means of a hinge slide or other equivalent, that it either may be inclined or turned down out of a vertical position, or be moved or slid outwards to such an extent as to permit a cop to be placed on it without interference with either the guide-rail or the yarn-guide.

"I also claim the arrangement of the friction fetter with respect to the yarn-guide, in combination with the so supporting it on the guide-rail by such a contrivance, viz., a hinged arm or slide or its equivalent, as will admit of said fetter being moved away from the guide sufficiently for the purpose stated; the said arrangement of the fetter with respect to the guide consisting in placing it directly in front of, and partially below, the guide, as described."

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36. For an *Improvement in Machinery for Working Lumber into Irregular Forms;* Rufus Powers, Prescott, Hampshire county, Massachusetts, May 8.

Claim.—"What I claim as new, is the combination of the clamp tongs, wedge, rock-shaft, lever, and inclined planes, with the carriage, as described, for the purpose of holding and supporting firmly slender pieces while being subjected to the action of the cutters, but releasing them while their position is being changed."

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37. For an *Improvement in Sewing Machines;* Jotham S. Conant, Dracut, Middlesex county, Massachusetts, May 8.

Claim.—"I claim the stationary point, (or any equivalent contrivance for supporting one end of the cloth,) and movable or adjustable clamping slider and point, in combination with the line or series of points or wires, the whole arranged and applied together in the manner and for the purpose specified."

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38. For an *Improved Method of Constructing and Operating the Header in Bolt Machines;* D. L. Weatherhead, Providence, Rhode Island, May 8.

Claim.—"I claim as my invention, the double header, constructed with an upsetting hollow frustrum, and a plane or projecting plane face, surface, or die, and made to operate with respect to the griping dies, in manner as specified: that is to say, by the action of the recess frustrum die, to first form a frustrum on the end of the rod, and next, by the action of the plane die, to upset the same into the head space of the griping dies, and thereby give to the head the form required; the sunken or recessed die having in the mean time been depressed in such a manner as to bring the flat die into the proper position for the completion of the head."

39. For an *Improvement in Sewing Machines;* John Bachelder, Boston, Massachusetts, May 8.

Claim.—"What I claim as my invention or improvement in the sewing machine, is the combination, with the endless cloth-holder, of the curved bar or piece of metal, for discharging the cloth from its points after being sewed, as described."

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40. For an *Improvement in Preparing Metallic Patterns for Castings;* Theodore G. Bucklin, West Troy, Albany county, New York, May 8.

The patentee says,—"The nature of my invention consists in converting the surface of iron castings into plumbago, by treating them with dilute acid, which dissolves out most of the iron, but leaves the carbon, which is insoluble in the menstruum, in the form of graphite or plumbago, which, when dry, is capable of being smoothed and polished, so as to made it suitable for the surface of patterns, and for the protection of the interior iron from oxidation."

Claim.—"What I claim as my invention, is the converting the surface of iron castings into plumbago, by treating them with dilute acid, and then reducing them to the required form and size, and smoothing and polishing them, in the manner and for the purpose set forth."

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41. For *Improvements in Machinery for Laying Ropes;* Martin Guild, Easton, Bristol county, Massachusetts, May 8.

Claim.—"What I claim as my invention, is a combination consisting of the guard, its rope and weight, and the lever shaft, with its arms, spring, shifting lever, and catch; the whole being applied to the spindle in the manner and for the purpose specified.

"I also claim the combination with the lever shaft, having arms, spring catch, and shifting lever, as described, or any other suitable mechanical equivalent for shifting the driving belt from the fast to the loose pulley, the slide bar, the spring lever, having an arm, and the pins inserted in the flyer head; the said combination being for the purpose of arresting the motion of the machine on the breaking of a strand."

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42. For an *Improvement in Annunciators for Railway Carriages;* Mason H. Ford, Boston, Massachusetts, May 8.

Claim.—"What I claim is as follows: 1st, The combination above described, to be operated by a movement of the trigger lever, by the conductor or any other person of the train, the said combination consisting, 1st, of the dial plate or disk and its tubular shaft; 2d, of the index hand and its shaft, the same having a ratchet wheel and retaining pawl, or not, as circumstances may require; 3d, the notched wheel affixed to the dial plate shaft; 4th, the pawl of said notched plate; 5th, the main spring; the said main spring being so connected to the index and dial plate shafts as to cause the dial to operate or turn around in one direction and indicate the stations, the whole being as described.

"2d, I claim, in combination with the mechanism above claimed, the

mechanism for reversing the motion of the dial plate, the same consisting of gear wheels, those fixed on the shaft *n'*, and said shaft, the tri-armed lever, and pinion *t*; the whole being applied together, and to the mechanism before claimed, and made to operate essentially as above described.

"3d, I claim, in combination with the mechanism herein first claimed, the mechanism which retards the rotary movement of the dial plate, and serves as an additional stop motion, the same consisting of the axle, gears, shaft, pinion *b*, catch wheel, and dog; the whole being made to operate and serve the purposes above mentioned.

"4th, I claim, in combination with the mechanism herein before first claimed, the alarm apparatus, the same consisting of the gear wheel, shaft *g*, pinion *h*, escapement wheel *i*, escapement *k*, pendulous hammer and bell; the whole being combined and made to operate as described.

"5th, In order to make the apparatus a self-operating or automatic machine, I claim a combination made up of the following elements or their mechanical equivalents, viz., 1st, one or more cams or inclined planes applied to the railway track; 2d, one or more legs affixed to a shaft connected with the car; also a cord or other contrivance so connected with the trigger lever and the shaft of the car, as to be operated as described when the leg passes up the inclined plane; 3d, the mechanism covered by the claim herein before first made, or any mechanism constructed and made to operate essentially like the same."

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13. For an *Improvement in Machinery for Dressing Staves;* Hervey Law, Wilmington, New Hanover county, North Carolina, May 8.

The patentee says,—"The purpose of my invention is to produce a machine which shall dress split staves, whether straight and flat, or crooked and twisted, of equal or unequal thicknesses or widths, wholly in conformity with the grain of the timber, and to joint, bevel, and curve their edges entirely in accordance with the convex and concave faces at every point throughout the length of the staves, so that, when set up with the truss hoops and every part sprung into place, perfectly regular staves shall have been produced, and a symmetrical cask thereby formed, the staves being all of uniform thickness and without cross-cutting of the grain."

Claim.—"What I claim as new, is the vibrating feeding bar, in combination with the carriage frame, which permits either the elevation or the depression of the rear end of the stave when passing under the weighted levers, as set forth.

"2d, I also claim, in combination, the pressure levers L L, acting independently of each other, but each in connexion with a weighted lever L' L', with the elevated plain support, with convex and concave revolving cutters, with the adjustable bevel-edged plate and curved support, forming a throat, whereby a stave, while being pushed forward as described, and undergoing the process of dressing, is held in positions constantly adapted to the various thicknesses, crooks, and windings of the timbers, without liability to be cut across the grain, substantially as set forth.

"3d, I also claim, in combination, the ratchet bar, the lever, tumbling shaft, supporting hand J, with the trigger or bent lever I, the pawls, the tripping bar and disengaging check on the carrying frame, arranged and

acting temporarily to sustain the stave while its rear end remains between the cutters, and after it has passed from under the weighted pressure levers L L, whereby the under thinning away of the stave near the end is prevented, in the manner set forth.

4th, I also claim the auxiliary saw carriage, in combination with a movable curved roller and springs, for regulating the breadth of the jointed stave to that of the bolt, as ascertained by gauging and adapting the amount of beveling to the breadth, whereby staves of unequal breadths may be so jointed as to be used in setting up the same cask, as herein set forth.

"5th, I also claim the combination of the reversed curved ways and the endless chain, working over angular or toothed rollers, with the swivel-jointed dogs, arranged and acting to receive the dressed stave and carry it forward, first in contact with one saw jointer and then with the other, whereby I am enable to joint successively both edges of the stave before it leaves the machine, and avoid handling the staves after the jointing has been commenced, as set forth.

"6th, I also claim the manner of arranging the adjustable jointing saw, curved roller and supporting springs, projection, and spring bars, whereby the true jointing of straight, crooked, or twisted staves is effected, the roller constituting, with the springs, a throat through which the dressed stave is made to pass in contact with the jointing saw, thereby enabling the bevel in every part of the length to correspond to the cross section of the stave, as set forth."

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44. For an *Improvement in Machinery for Cutting Soles of Boots and Shoes;* Abram D. Boynton, Haverhill, Essex county, Massachusetts, May 8.

Claim.—"What I claim as my invention, is as follows: that is to say, I claim the combination of the four frames, and the moving toe frame, for receiving and holding the shaping blocks of the cutting knives, the said frames being connected and operated by screws, in manner and for the purpose specified.

"I also claim the combination of two sets of holding and shaping blocks, operated as above specified, and whether used on either or both sides of the machine, and for the purpose of sharpening the knife, so as to cut a right or left sole of what are termed 'rights and lefts,' all as set forth."

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45. For an *Improvement in Tarring Rope Yarns;* William Montgomery and George H. Williams, Jr., assignees of William Montgomery, Roxbury, Norfolk county, Massachusetts, May 8.

Claim.—"What I claim as my invention, is heating the yarns previous to their immersion in, or passage through, the tar, and using the tar either at the temperature of the atmosphere surrounding it, or at a temperature of blood heat or thereabouts, and not one which small materially volatilize or evaporate its essential oil or spirit, in comparison with the evaporating of the same, which takes place under the old process above described."

46. For an *Improvement in the Combustion of Fuel;* Samuel G. Fisher, Mobile, Alabama, assignee of Richard Coad, Kensington, England, May 8; dated in England November 25, 1847.

Claim.—"What I claim is the mode of constructing furnaces, whereby numerous streams of air are caused to pass above the fire bars, through perforated fire brick, lump, or suitable stone, at the sides and front of such furnaces, in combination with the arrangement for making the products of combustion pass through and beyond reticulate partitions of the same materials, before they come in contact with the surfaces or objects intended to be heated, in the manner and for the purposes set forth."

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47. For an *Improvement in Machines for Cutting and Slitting Cheese Hoops, &c.;* Elkanah Ring, Jr., and Thomas Ring, Worthington, Hampshire county, assignees of Patrick Bryant, Chesterfield, Hampshire county, Massachusetts, May 15.

The patentee says,—"The nature of my invention consists in providing a slitting knife to the stock in such a manner that the stock, with the knife, is attached to the frame with a strap below and a hinge above, so that the knife can be swung on its axis (hinge) to be sharpened. Also in providing a movable face-place to regulate the thickness of the slit, &c., when a single knife only is used, in combination with which I provide a movable gauge and a movable set of strippers; also a duplicate set of knifes in a stock, to cut two slits at one stroke."

Claim.—"I claim the knife stock, attached to the movable frame in such a manner as to swing up the knife for the purpose of sharpening the same, either by attaching the stock to the frame by hinges above and a clasp below, or for such equivalents as will make the knife stock movable, in the manner and for the purposes set forth.

"I also claim the combination of the movable face-plate with the slide or stock, in such a manner that the position of the face-plate can be changed during the operation of the machine, for the purpose of counteracting the effects produced by the springing of the knife in passing through the central and hardest portion of a piece of wood, and thereby enabling the operator to perfectly govern the thickness of the veneers or splints cut from different parts of the same piece of wood, without stopping the machine.

"I also claim the combination of the pointed slitters with the slide or stock, in such a manner that they (the pointed slitters) can, while the machine is in motion, be thrown into use to act in combination with the knife, when their services are required, and be thrown out of use again without stopping the machine, when their services are no longer needed, as set forth."

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48. For an *Improvement in the Cut-Off and Steam Step of Rotary Engines;* Benj. Gould, assignee of Joseph W. Webb, Ledyard, Cayuga county, New York, May 15.

Claim.—"What I claim as my invention, is the cut-off valves constructed with apertures through them, and fastened to the steam stops, acting in the manner and for the purpose described.

"I also claim the combination of the cut-off valve, and of the curved apertures, with the arc and radius steam stops, arranged in the manner and for the purpose set forth."

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49. For an *Improvement in Chimney Caps;* Charles K. Scudder, Brooklyn, Kings county, New York, May 15.

Claim.—"I claim as new and of my own invention, the application of the obtuse frustrum 2, having holes opening under the frustrum *b*, to admit the exterior current of air into the truncated continuation 4 of the shaft, when such application is in combination with the inverted frustrum *c*, above and detached from, but surrounding, the part 4, to pass the exterior current under the cap *d;* the whole combined and operating substantially as described."

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50. For an *Improvement in Harvesters;* James L. and Henry K. Fountain, Rockford, Winnebago county, Illinois, May 15.

The patentees say,—The nature of our invention and improvement consists in giving to the cutting blade a striking motion towards the grain, at the same time that it is drawn transversely against it, which is found greatly to facilitate the cutting, rendering it both more perfect and diminishing the force necessary to effect it."

Claim.—"What we claim as new, is giving to a vibrating blade a compound transverse and horizontal stroke or cut, by combining it with jointed vibrating levers, or other similar device capable of producing the same movement, when the same is combined with stationary teeth or a reel, substantially in the manner and for the purpose herein set forth."

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51. For an *Improvement in Bedstead Fastenings;* James Brooke, Baltimore, Fairfield county, Ohio, May 15.

The patentee says,—"The nature of my invention consists in cutting a groove concentric with the circular mortise for the tenon of the rail, inserting a catch-pin therein, and attaching to the rail, in the line of the curve of the concentric groove, when the tenon is applied to the mortise, a hook, wedge-shaped next the rail and from point to butt, so that as it is passed down behind and pressed upon the pin in the concentric groove, it draws the post tightly against the rail."

Claim.—"What I claim, is fastening the post of a bedstead to the rail, (or the rail to the post,) by means of a hook, wedge-shaped from point to butt, next its attachment, and a groove having a catch-pin therein, which groove is concentric with the axis of the joint, substantially as described and set forth, whether placed at one or another point of the sweep of its circle, the hook being correspondingly attached."

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52. For an *Improvement in Grain Separators;* Homer Smith, Hector, Tompkins county, New York, May 15.

Claim.—"What I claim as my invention, is the construction and use of a fly or paddle, to carry the grain from carrier to carrier."

53. For an *Improved Lock for Fire Arms;* Jacob Post, Newark, Essex county, New Jersey, May 15.

The patentee says,—"The nature of my invention and improvement consists in attaching to, or manufacturing with, any gun or pistol, or any gun or pistol lock which operates upon the so termed 'self-cocking' principle, the seer acting in combination with the set or tumbler *b*, and the adjustable set or tumbler screw *c*, or its equivalent, the effect of each and all of which is described hereinafter."

Claim.—"What I claim, is the combination of the seer, the set or tumbler, and the set or tumbler screw or its equivalent, whether the same be adjustable or not; the whole acting substantially in the manner and for the purpose hereinbefore described."

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54. For an *Improvement in Straw Cutters;* Jonathan White, Antrim, Hillsborough county, New Hampshire, May 15.

Claim.—"I claim the combination of the rake with one or more sets of reducing or cutting knives or edges, and the conductor straw-holder or shoe, the said rake being made to operate therewith substantially as described.

"I also claim the combination of mechanism by which the rake is operated, the same consisting of the slide bars or rods and their connexions with the rake, one or two of the levers F, made with or without its projections as occasion may require, the stop, or the screw, or other equivalent contrivances, applied to each lever F; the whole being substantially as specified."

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55. For an *Improved Method of Moving and Fastening Window Blinds;* Cheney Reed, Cambridge, Middlesex county, Massachusetts, May 15.

Claim.—"What I claim as my invention, is the combination of a turning, pressing, or bearing roller, with an inclined plane or cam formed on that portion of the lower hinge which is attached to the blind, substantially as set forth."

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56. For an *Improvement in Packing of Rotary Pumps;* Albigence W. Cary, Rockport, Monroe county, New York, May 15.

The patentee says,—"1st, The nature of my invention consists in providing a perforated partition or wing between the supply and exhaust tubes and the chamber in which the pistons revolve, to act as a strainer, to prevent sand and other impurities getting into the chamber.

"2d, It farther consists in providing the perforated partition with a metallic butt, having its interior end packed with spring or other packing, so as to have it fit snug or lie in close contact with the revolving drum, and effectually secure a separation between the induction and eduction openings.

"3d, It further consists in providing sliding pistons or valves, which slide in slots in the drum, and in providing said pistons with packing on the outer ends, and also on the upper and under or sliding surfaces; and also in providing the said pistons with small side orifices communicating with interior orifices, to allow a small amount of steam, &c., to get under

the packing when the engine is in operation, to expand gently the packing, and make the pistons move in the chamber in close contact with all parts of the cylinder. In connexion with this part of my invention, I provide spring bolts fitted into openings in the back part of the pistons, and having the heads of said bolts press against the periphery of an interior cam, so as to press out the pistons against the interior rim of the cylinder, so as to have the ends of the piston always in close contact with the said part of the cylinder.

"4th, I also provide circular grooves in the plates of the cylinder or chamber, for the drum to move in, and I provide the said grooves with any kind of packing most suitable.

"5th, I also provide a small groove on each side in the slots of the drum in which the pistons slide, and I provide the said grooves with any kind of packing substance most suitable, to prevent the steam, water, &c., getting into the interior of the drum from the chamber, and also for the purpose of lessening the friction of the pistons when moving in the said slots of the movable drum."

Claim.—"I claim the pistons, packed as described, and with small orifices in the pistons, to allow steam, water, &c., to be admitted, as described, under or inside of the packing when the engine is in operation, for the purpose set forth."

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57. For an *Improvement in Atmospheric Churns;* Jos. C. Coult and Aug. B. Davis, Philadelphia, Pennsylvania, May 15; anté dated March 19.

Claim.—"What we claim as our invention, is the air chamber formed by the partition, with the slot and passage. We claim the invention of a churn having a passage formed substantially as above described, and which operates so that the motion of the milk or cream will create a constant supply of fresh air passing in through said passage into the milk and out at another passage, substantially in the manner and for the purpose set forth."

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58. For a *Revolving Die Spike Machine;* Nathan Richards, Medford, Massachusetts, and Lucius C. Alexander, Nashua, New Hampshire, assignees of A. M. George, Nashua, Hillsborough county, New Hampshire, and Ephrain Brown, Lowell, Massachusetts, May 18.

Claim.—"What we claim as our invention in each set of griping or beading dies of the series, is the combination of the fixed die, the movable die, the curved bar, the cam plate with its cam, and the arc or cam, the same being applied to the shafts and adjusted together, and made to operate essentially in the manner as specified.

"We also claim the combination of the series of rotating, pointing, and severing dies, the conductor and the series of griping and beading dies, as constructed, combined, and arranged, and made to operate substantially as described."

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59. For *Improvements in Boring and Mortising Machines;* Chandler Carter, Manchester, Washtenaw county, Michigan, May 22.

Claim.—"What I claim as my invention, is the conbination of an auger

and two chisels with the several parts which regulate their operation, for the purpose of boring and mortising hubs, as the method by which the auger is brought to use through the auger gate, the stands with the arrangment of the pulleys, the operation and government of two chisels through the use of fenders, long cog on chisel stock, slides and spring catch, wedges and rag-iron, rods and springs, stoppers and springs which throw the fenders apart laterally, the combination being more particularly described in the specifications."

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60. For an *Improvement in Bench Planes;* Charles S. Beardsley, Auburn, Cayuga county, New York, and Simeon Wood, City of New York, May 22.

The patentees say,—"The nature of the first part of our invention consists in making the surface of the plane, from the cutting edge back, on a level with the cutting edge, and the surface forward of the cutting edge parallel with the rear part, but movable and adjustable, that it may be set so much above the level of the rear part as to determine the thickness of the shaving to be cut, and constitute a guage for this purpose, and thus permit the entire surface of the plane back of the cutting edge to rest and run on the planed surface, whilst the forward part or gauge runs on the part from which the shaving has not been cut.

"And our invention also consists in making one surface of the planing bit or cutter the rear part of the surface of the plane, when this is combined with the making of the rear part of the stock, from the throat of the plane to the back, hollow for the passage and discharge of the shavings."

Claim.—"We claim constructing and applying the bit or cutter substantially as described, that its lower surface may constitute that part of the surface of the plane back of the cutting edge, in combination with the hollow stock for the passage and delivery of shavings, substantially as described."

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61. For an *Improved Method of Manufacturing Drop Shot;* David Smith, City of New York, May 22.

The patentee says,—"The main feature of my invention consists in causing the fused metal to fall through an ascending current of air, which shall travel at such a velocity that the dropping metal shall come in contact with the same number or more particles of air, in a short tower, than it would in falling through the high towers heretofore found necessary."

Claim.—"What I claim as new, is the application of an ascending artificial current of air, to cool the descending metal, in the manufacture of drop shot."

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62. For an *Improvement in Speeder Flyers;* Theodore T. Abbot, Manchester, Hillsborough county, New Hampshire, May 22.

Claim.—"What I claim as my invention, is making the flyer of hollow tubular arms, constructed as described, of equal thickness throughout, combined with the top and bottom piece, substantially in the manner and for the purposes set forth, whereby the condensation of moisture is almost

entirely obviated, which is so injurious in practice with the ordinary flyer; the tube through which the roving passes is enlarged to the greatest possible dimensions, the parts are greatly increased in stiffness and lightness, and are found to be more durable and require less power to drive them, and by this mode of construction I am enabled to use a material, to wit, steel, that has never before been deemed practicable."

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63. For a *Disk Cut-Off Acted Upon and Regulated by the Governor;* Wm. M'Cammon, Albany, New York, May 22.

Claim.—"What I claim as my invention, is a cylinder moving freely on the spindle of the governor of the steam engine, and operated by the balls thereof, having therein a slot or slots with one vertical and one inclined side, by means of which lever and other apparatus, arranged essentially as described in the above specification, regulate the opening and shutting of a throttle valve in the steam pipe, so as to cut off the steam at any desired portion of the stroke, varying according to the speed of the engine."

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64. For *Improvements in Cotton Gins;* William Y. Layton, Darlington, Darlington district, South Carolina, May 22.

Claim.—"What I claim as my invention in the before described improved roller cotton gin, is, 1st, the combination of the adjustable bearings or boxes and screws with the rollers and hinged caps, for supporting, holding, and adjusting the rollers at the several points between their ends, where said bearings are applied and are liable to wear, arranged and operating substantially in the manner and for the purpose set forth, by which the operator is enabled to retain a parallelism of revolving surfaces, however unevenly the bearings may wear; the rollers being made to coincide by separate and independent screws and tops, or wedges, or in any way by which the same object may be attained, and by which the rollers shall be made to produce equal pressure on the cotton wool as it passes between them.

"2d, I likewise claim the combination of the hinged caps with the hinged plate forming the upper end bearings, and the brush block and brushes arranged and operating in such manner as to admit of their being raised from the rolls."

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65. For *Improvements in Mill Shafting;* Edward Bancroft, Philadelphia, Pennsylvania, May 22.

The patentee says,—"This improvement consists in making the hangers or bearings which sustain the shafts, in such a manner that they shall, at all times and under any circumstances, conform accurately to the journals of the shafts, and at the same time not be more liable to be thrown 'out of line' than hangers of the ordinary construction; and further, in making the oil-catcher form a part of the box of the hanger, by casting it thereto, thus giving it additional strength without unnecessarily increasing its weight."

Claim.—"What I claim as my invention, is the general arrangement

and construction of the complete hanger, with or without the oil-catcher forming a part thereof, made substantially in the manner and for the purposes above described."

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66. For an *Improvement in Hames;* Joseph W. Briggs, Cleveland, Cuyahoga county, Ohio, May 22.

The patentee says,—"The nature of my invention and improvement consists in so constructing and arranging the cliff and padded hames, that the latter will at all times, when the horse is pulling, lay flat and press equally upon every part of his shoulders and breast, which it overlies, which is the only certain and effectual way in which they can be prevented from being pressed and galled."

Claim.—"What I claim as my invention, is hinging the cliffs to the hame, and extending them back to the girth, substantially as herein described, for the purpose of holding the hame flat against, and in contact with, the entire length of the shoulder of the horse in every position he may assume while in the act of pulling."

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68. For a *Method of Opening, Shutting, and Fastening Blinds;* Wesley Chase, Buffalo, New York, May 22.

The patentee says,—"My invention and improvement consists in casting or otherwise securing pinions, of equal size and similar form, upon the stationary and movable parts respectively of butt hinges, in such a manner that they will both be concentric with the axis of the hinge, and parallel with, and either resting upon or near each other, a turning rack being provided which takes into the pinion of the movable part, which it turns when moved longitudinally either way, and giving to the door or blind to which it is attached a corresponding motion, until it is brought into the required position, when the rack is turned so as to engage its teeth in both the fixed and movable pinion, which thus locks them with the parts of the hinge to which they are respectively attached firmly together, and in this manner fastens the door shut or open at any required angle."

Claim.—"What I claim as my invention, is the combination of the turning rack with the fixed and movable pinions attached to the hinge, substantially in the manner and for the purpose herein described."

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69. For an *Improved Keyhole Protector;* Edward Kershaw, Boston, Massachusetts, May 22.

Claim.—"What I claim, is a series of slide plates or tumblers, or their equivalents, and a key passage for operating the same, (by means of a key,) so applied to the slide F, and enclosing case A, as to enable a person to insert the key and throw or move the slide or gate forwards or backwards without, (either while the slide or gate is being thrown forwards or is being retracted,) there being any such communication with the interior of the case as will allow of the admission of gunpowder or any explosive solid material therein, substantially as specified, the said slide or bolt tumblers and key passage being enclosed or included in a close box, and the whole forming together a 'keyhole protector,' as explained."

70. For *Improvements in Propelling Vessels by Reaction;* Morris W. Ruthven, City of New York, May 22.

Claim.—"What I claim as my invention, is, 1st, the combination of a centrifugal pump, constructed substantially as described, with the curved guide plates, by which means the water is put in motion, and raised and discharged, with less expenditure of force than the ordinary means now in use for propelling vessels by means of pumps.

"2d, I claim the bent nozzle pipe attached to the stationary pipe, and capable of motion in a vertical plane, by means of which the water may be discharged either fore or aft, up or down, with only one aperture, and without the use of valves."

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71. For an *Improved Method of Lifting Vessels over Shoals;* Abraham Lincoln, Springfield, Sangamon county, Illinois, May 22.

Claim.—"What I claim as my invention, is the combination of the expansible buoyant chambers, placed at the sides of a vessel, with the main shaft or shafts, by means of the sliding spars or shafts, which pass down through the buoyant chambers and are made fast to their bottoms, and the series of ropes and pulleys, or their equivalents, in such a manner that, by turning the main shaft or shafts in one direction, the buoyant chambers will be forced downwards into the water, and at the same time expanded and filled with air, for buoying up the vessel by the displacement of water; and by turning the shaft in an opposite direction, the buoyant chambers will be contracted into a small space and secured against injury."

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72. For an *Improvement in Machines for Jointing Staves;* William H. Seymour, Stocton, Chatauque county, New York, May 22.

The patentee says,—"The nature of this invention and improvement consists in securing to an upright sliding frame, operated by any convenient power, a steel knife, curved in the form of a segment of a circle, and made of the form of an obtuse angle on its lower edge, and arranging immediately in front of the same an inclined table or rest, on which the staves to be jointed are placed, in such a manner that, when the sliding gate descends, the knife will cut the edges of the staves to the required bevel and taper, and bilge, and prepare it for setting up without further operation."

Claim.—"I claim the combination of the inclined angular levers with the oblong plates secured to the edges of the sliding frame, for holding the ends of the stave during the operation of jointing, as described."

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73. For an *Improvement in Imitations of Marble;* Samuel W. Davis, Cincinnati, Ohio, May 22.

Claim.—"What I claim as my discovery in the before described process of marbling minerals, woods, and other substances, is, 1st, the employment of strong acid, as described; in the preparation and application of colors for producing appearances of marble on woods and minerals.

"2d, I claim the application of lime and nitre as receiving mordants,

adapted to minerals and wood where veins or variations are to be produced, imitating marble, as herein set forth.

"3d, I claim the use of mucilaginous pastes, composed of corn meal, slippery elm bark, or rice water, applied to canvas, paper, gum elastic, &c., for purposes stated in the specification.

"4th, I claim the process of preparing, and of transferring, the colors from a temporary to a permanent ground, in the manner and for the purposes described.

"5th, I claim the composition of glass, lime, shellac, nitro-muriate of zinc or aqua regia, and alcohol, as a compound hard polish for marbling wood and porous mineral surfaces, as described."

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74. For an *Improvement in Spring Saddles;* Jeremiah Rhoades and Wm. Pouley, Shippensburg, Cumberland county, Pennsylvania, May 22.

Claim.—"What we claim as our invention, is the combination and arrangement of the bent tension springs, for supporting the saddle seat, with the pommel and cantle of the tree, in such a manner as to effectually preserve the proper form of the springs, and also prevent all upward reaction and tremor of the same when in use, substantially as set forth: to wit, securing the front ends of the springs to the sides of the pommel, by means of bolts or screws, and springing the rear ends of the said springs into inclined grooves formed in the cantle, and confining them therein by screws passing through slots in the springs into the bottom of the said grooves."

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75. For an *Improved Shank for Mineral Door Knobs;* Joshua Laird, Cincinnati, Ohio, May 22.

The patentee says,—"The nature of my invention consists in manufacturing mineral door knobs, or other analogous articles, by inserting tubular shanks therein."

Claim.—"What I claim as new, is making mineral knobs or other analogous articles, such as curtain pins, drawer handles, &c., by inserting a tubular metallic shank (with or without slots or a longitudinal slit) into the vitreous or earthen matter at a proper stage of the process, so that the quantity of metal, in proportion to the bulk of mineral admissible in the case, and comparatively to the extent of surface in contact with the mineral, is very small, and the mineral consequently allowed to take its set about, within, or around the more or less elastic shank, without any undue strain upon, or disturbance with its crystallization; thus rendering the destructive tendencies arising from the unequal expansibility of the metal and mineral too slight, practically, to endanger the soundness and durability of the finished knob or other analogous articles, such as curtain pins, drawer handles, &c."

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76. For an *Improvement in Scythe Nibs;* David Sawyer, Cornish, Sullivan county, New Hampshire, May 22.

The patentee says,—"The nature of my invention consists, 1st, in making all the parts of the thole on which its attachment to the snath depends of

iron or other metal, by which any wear of the haft at the point of attachment is prevented.

"2d, By securing the ends of the loop by a ring, any welding of the loop is avoided.

"3d, In having the attaching screw, with a pivot point, act in a socket against the inner side of the cap, a less power on the screw is required, an equal bearing or pressure on the sides of the loop is effected, and the thole may be attached to any part of the snath (large or small) without affecting the length of the thole, or requiring any alteration of any part of the iron work.

"4th, By placing the wrench within the barrel of the haft, the loop is first firmly attached to the snath, and then the haft to the attaching screw by the fixed nut, and by being thus separately and independently attached, any derangement of the one will not affect the other.

"5th, The thole may be attached to the snath by a right or left-handed screw, the haft being attached by a left-handed screw in the fixed nut; the first being screwed hard down, will not be affected by the slight force required to secure the latter."

Claim.—"What I claim as my invention, is the wrench part of the screw rod, combined with the rings for fastening the nib upon the snath, as described and represented, to effect the objects stated in the 1st, 2d, 3d, and 4th particulars herein before stated."

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77. For an *Improvement in Harvesters of Clover Heads;* John Hinton, Pack's Ferry, Monroe county, Virginia, May 22.

The patentee says,—"The nature of my invention and improvement consists in a novel combination and arrangement of an adjustive pendant bar, to which is secured a row of metallic fingers, and a knife or cutter and right angled mortised plates; and in the arrangement of spring conveyor bars attached to the axletree of the propelling wheel, and caused to rotate with the same, by which the stems or stalks of clover heads are forced against the knife between the fingers, severed, and conveyed to a receiver."

Claim.—"What I claim as my invention, is, 1st, the combination and arrangement of the transverse pendant finger bar, the mortised right angled plates, adjustive slide bars, or knife or cutter, with the revolving axletree of spring conveyor bars, arranged and operating in the manner described, by which the heads of clover are severed from the stems or stalks, and conveyed to a receiver.

"2d, I also claim the combination of the right angled rods, fingers, and pendant bar, with the transverse timber, for adjusting the knife and fingers longitudinally and vertically in connexion with the spring conveyor bars, as described and represented."

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78. For an *Improvement in Harvesting Machines;* Alfred J. Purviance, Updegraffs, Jefferson county, Ohio, May 22.

The patentee says,—"The nature of my improvements consists, 1st, in the connexion of the movable knives with the gearing, by means of a slide made on one end of a bar of iron to which the movable knives are

attached, said slide working between ways firmly bolted together, and to a platform, and connecting with a pitman rod, and therefore not liable to become uncoupled, as is the case with many reapers now in use, whilst at the same time there is much less friction, and hence less wear of material.

"My second improvement consists in the manner of constructing the platform separate from the other framework of the machine, whereby the whole of the platform and reel can be removed, and the mower attached in a few minutes ready for mowing."

Claim.—"What I claim as new, is constructing the platform separate from the other framework, as described, so that it can be readily put together or removed, and the mower attached as described."

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79. For an *Improvement in Buckles for Harness;* Hiram Todd, Columbus, Franklin county, Ohio, May 22.

Claim.—"What I claim as my invention, is the safety plate, buckle frame, and tongue, combined together in the manner and for the purposes set forth."

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80. For an *Improvement in Cooking Stoves;* Daniel Dunham, Pawtucket, Providence county, Rhode Island, May 29.

Claim.—"What I claim as of my invention, is the combination of the central upright steam column with the top plate, and the fire chamber made to rotate or turn around underneath the said top plate, all substantially as specified.

"I also claim the plate K', and space over it, as combined with the fuel chamber and rotary plate, and made to revolve simultaneously with them, in manner and for the purpose essentially as specified."

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81. For an *Improvement in Cooking Stoves;* Horace Halbert, Utica, Oneida county, New York, May 29.

The patentee says,—"The design and nature of my improvement is to furnish a front draft to the stove, directly opposite to the side of the wood to be kindled, while at the same time, by a peculiar arrangement of the valves and flues, a useful distribution of heat is obtained by one revolution of the heated air throughout the stove."

Claim.—"What I claim as my invention, is the dropping of the flue *s t* below the level of the hearth plate, in combination with the two ovens, arranged in the manner set forth and described."

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82. For a *Direct and Counter-Motion Winch;* Charles Perley, City of New York, May 29.

Claim.—"I claim as new, the application of the female ratchet, conjointly with the mechanical arrangement of the head or cap, with the two reversing pawls and lever socket, to produce a winch that shall be worked

by a handspike or lever, moving in either direction on the winch centre, for the purposes and substantially in the manner before described."

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83. For an *Improvement in Machinery for Cutting Welts for Shoes;* Chas. Rogers, East Bridgewater, Plymouth county, Massachusetts, May 29.

Claim.—"What I claim as my invention, is the combination of the strip holder with the knife, base block, spring gauge plate, spring support plate, and ledge; the whole forming a machine for manufacturing wilts, substantially as specified."

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84. For an *Improved Method of Attaching the Tang to the Handle of Table Cutlery;* David N. Ropes, Meriden, New Haven county, Connecticut, May 29.

Claim.—"What I claim as my invention, is the mode of constructing and combining, or fixing together, the handle and tang of the blade of a knife or piece or cutlery, the same consisting in making the said tang with one or more stationary studs or projections, in combination with making the main tang passage of the handle with lateral and transverse passages for the entrance and reception of the said projection or projections during the process of cementing, all substantially as specified; the handle, by such means, being firmly secured to the blade or tang thereof, and so as to permit no appearance of any rivet on its external surface."

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85. For an *Improvement in Bedstead Fastenings;* Devolt Stoltemeyer, Hancock, Washington county, Maryland, May 29.

Claim.—"What I claim as my invention is, the construction of metallic fastenings, for confining the rails and posts of bedsteads to each other, of such forms that, when the portions of the fastening secured in the ends of the rails are inserted into the portions of the fastenings attached to the posts, a blow or downward pressure upon the rails will cause the ends of the rails to be closely drawn against and secured to the posts; when this is combined with the arrangement by which the elevation of the rails for a short distance will permit them to revolve and detach themselves from the cords or sacking that may be connected to them, and also disconnect the portions of the fastenings projecting from the extremities of the rails from their hold upon the fastenings made fast to the posts, without withdrawing one from the other, substantially in the manner and for the purpose set forth."

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86. For *Improvements in Boring Machines;* William H. Willcox, Tarrytown, West Chester county, New York, May 29.

Claim.—"What I claim as my invention, is the combination of the boring apparatus with the four jointed posts, the mode of adjusting the frame by means of the straps, and the windlass shafts and the jointed posts, as described."

87. For an *Improvement in Stops for Carpenters' Benches;* Lebbeus Augur and James L. Lord, Chester, Middlesex county, Connecticut, May 29.

Claim.—"What we claim as our invention, is that peculiarity of the construction of the socket which consists in the vertical aperture."

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88. For an *Improvement in Pumps;* George W. Fulton, Baltimore, Maryland, May 29.

Claim.—"What I claim as my invention, is the union of two parallel pump cylinders by means of a curved pipe, as described, and the working of pistons with valves in each, said pistons being united in motion, and the valves arranged substantially as set forth.

"I also claim the union of two such pumps in the manner and for the purpose described."

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89. For *Improvements in Looms;* John Wilson, Gentsville, Abbeville district, South Carolina, May 29.

The patentee says,—"The improvements consist in the shaft commonly called the cam shaft, in the position usually occupied by the crank shaft, and affixing to each end thereof an apparatus which I denominate the quadrangular wheel, that is connected with the lay, so as to give two beats to every revolution of the shaft."

Claim.—"What I claim as new, is the combination of the quadrant wheel or trammel with the cam shaft of a power loom, by means of which I can locate the said shaft in the position of the crank shaft, and dispense with one shaft and the ordinary gearing connected therewith."

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90. For an *Improvement in Gates;* Lorenzo Smith, Easton, Bristol county, Massachusetts, May 29.

Claim.—"What I claim as my invention, is a single or double gate, constructed substantially as described, so as to turn up vertically by the parallel movements of the rails, &c., in lieu of swinging each way in the ordinary manner."

RE-ISSUES FOR MAY, 1849.

1. For an *Improvement in Floating Dry Docks;* John Thomas, Elizabethtown, Essex county, New Jersey; patented December 20, 1837, reissued May 1.

The patentee says,—"The nature of my invention consists in providing a number of strong trussed frames, connected together by strong beams at the upper and lower parts. In the space formed by the frames and beams are placed tanks or floats, in which water is let in through cocks or gates. When the dock is sunk to a depth sufficient to float the ship over the keel blocks, to raise the ship a part of the water is to be pumped out. When the dock, with its load, rises above the water a sufficient height to enable the workmen to perform the various repairs on the bottom

of the ship. Other floats or tanks are placed at each end of each section to preserve the equilibrium."

Claim.—"What I claim as my invention, is, 1st, the end floats, by means of which the dock may be balanced and leveled, and which may be forced down by machinery, substantially as described.

"2d, I claim regulating the line of motion of said floats, and of applying the control exerted by them to the dock by means of guides and frames, in which they are made to move; the whole operating and constituted substantially as described."

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2. For an *Improvement in Hot Air Registers;* Charles F. Tuttle, Williamsburg, Kings county, New York; patented January 23, 1849, re-issued May 1.

The patentee says,—"The nature of my invention consists in the new and improved method adopted in opening and closing the register ventilator, by means of an upright or vertical wheel, or a segment of a wheel, which is connected with, and gives motion to, the valves, by means of a movable connecting rod, which is suspended on the side of the wheel on a pin projecting therefrom; and this connecting rod is attached to the valves by pins at their ends."

Claim.—"What I claim, is the application of the upright or vertical wheel, or part or segment of a wheel, to the opening and closing of hot air registers and ventilators, the edge or periphery of which is placed flush or nearly so with the top surface of the register, and can be acted upon by the foot if desired; the wheel, or part of a wheel, so placed imparting motion to the valves through a connecting rod or rods, which are connected or attached to the wheel at a point distant from its axis, and to the valves by pins at a distance from their centres of motion; the connecting rod or rods moving in a circular direction with, and corresponding to the motion of, the valves that are moved."

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3. For an *Improvement in Atmospheric Churn Dashers;* Charles J. Anthony, assignee of Nathan Chapin, Syracuse, Onondaga county, New York; patented May 9, 1848, re-issued May 15.

The patentee says,—"The nature of my invention consists in the employment of open-mouthed buckets or beaters, having a cavity or cavities formed in their front or beating surfaces, in a vessel partially filled with milk or cream, for the purpose of enabling the buckets or beaters, as they are operated, to pass through air and cream or milk, and thereby to force quantities of air into and amongst the cream or milk, and to lift portions of the cream or milk into the atmosphere in the upper portion of the churn, by means of the said cavities in the beaters, by which the agitating mechanical action produced by the beaters will be greatly increased, at the same time that a chemical influence is exerted by the oxygen of the atmosphere, that will greatly accelerate the production of butter."

Claim.—"What I claim as my invention, is the employment of open-mouthed buckets or beaters, having a cavity or cavities formed in their front or beating surfaces, in a vessel partially filled with milk or cream, for

the purpose of enabling the buckets or beaters, as they are operated, to pass through air and cream or milk, and thereby to force quantities of air into the cream or milk, and to lift portions of the cream or milk into the atmosphere in the upper portion of the churn, by means of the said cavities in the beaters, for the purpose herein set forth."

DESIGNS FOR MAY, 1849.

1. For a *Design for Stoves;* Morrison & Tibbitts, assignees of Abram Haney, Troy, New York, May 8.

Claim.—"What I claim as my invention, is the design of an air-tight wood parlor stove, as shown and described in the specification and drawings."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Account of the Explosion of the Steamboat "Louisiana," at New Orleans. By A. C. JONES, ESQ., *Civ. Eng.*

(With a Plate.)

On the 15th November, at about 5 P. M., an explosion occurred on board of the "Louisiana," a new first class boat, lying at the levee, which has been more destructive to lives and property than any which has come under my notice. Up to this date, 74 bodies have been found, or have died since the explosion, and 50 remain wounded, some of whom cannot live.

The hull sunk within six or eight minutes after the explosion, carrying down with it many persons entangled in the wreck; about 20 feet, uninjured, of the ladies' cabin floated, and enabled many to be taken from it. The great destruction of lives on shore, was in consequence of the large number of persons which usually assemble to see a boat off. Several were killed hundreds of feet distant by the fragments, and also many on the boats alongside.

On the larboard side of the "Louisiana" was the steamboat "Bostona;" much of her upper works and chimnies were destroyed. The steam drum of the "Louisiana" was thrown on the "Bostona," and remained hanging vertically, by one of the connexion pipes hooking on to the hand rail of the boiler deck, its position being at *r* of the diagram.

The steamboat "Storm" was about making her landing at the time, and nearly the whole of the side of her upper works and chimnies were destroyed; her deck load of cotton protected her from receiving greater injury.

For a clearer understanding of some of the incidents of this explosion, I will give the elevation of the "Storm's" upper works, as our boats differ very much from those at the North. About 10 feet above the main deck (of the hull) is the saloon or cabin, being nearly the whole length of the boat. The top of the cabin, being the hurricane deck, has another story

on it, containing state rooms for the officers of the boat, and still perched above this is the pilot or wheel house.

The accompanying diagram is an approximation of the position of the boats and principal fragments, with their supposed distances from the "Louisiana's" deck.

a, (Plate I.) The "Louisiana."

b, The "Bostona."

c, The "Storm."

d d, The line of the levee.

e, The original position of the boilers.

f, is a large part of one boiler, and the only piece landed that retains its original appearance. (See fig. 3.) It left the boat end on until it passed about 660 feet; it then struck a mule, cutting its entire hind part away, leaving but the two hoofs and small portions of the hind legs uninjured. About the same time a man was mutilated. It then came in contact with some bales of cotton, and left part a loose heap. By this contact it glanced, and its position was reversed; it continued on about 95 feet, knocking down two iron columns of a portico, and landed within a few feet of the wall of the house, with what had been its front end pointing towards the river.

h, is a piece of the shell, about 5×11 feet, flattened out to nearly a plane surface; what were the inside edges of the sheets are chamfered or beveled off, (an unusual thing,) leaving in some places less than half an inch of metal outside the holes.

i, is the place were five pieces of the chimney landed, they being part of the "Louisiana" and "Bostona."

k, is the distance to which a piece of the hog chain (fig. 1) was carried; it is of $1\frac{1}{4}$ inch round iron, about 4 feet long, having a heavy hinged jaw riveted to it. This darted on till it came in contact with a druggist's copper mortar, about 15 feet from the ground, bruising it, and it then passed end on through a sign board 1 inch thick, and lodged in the second story of a house 20 feet off. The great velocity of this bolt cut out a clean piece of the board the size of its flat end, which is compressed to half its thickness, and remains firmly embedded to the end.

l, a small piece of shell doubled up.

m, is one-half of a cast iron head; it is entirely separated from the shell and flues.

n, is a piece of the flattened shell, 6×6 feet.

o, (see fig. 2,) is also a piece of the shell, 8×11 feet, flattened out except a small piece which is doubled over; this has the inside edges of the sheets beveled like *h*. This piece was carried upward about 25 feet, and, after cutting away the front and parts of the side of the third story of the "Storm," remained on the hurricane deck, just filling the oblong space, as seen by the dotted lines, which had been a state room, the bedding and other things being under it. Immediately over this room, two of the upright boards forming the side of the pilot house, were broken in by the body of a negro thrown from the "Louisiana," and he lodged alongside of the pilot, who escaped with a slight cut on the hand

p, is the place of the safety valve and part of its connecting pipe; the valve and seat are in good order, and the lever is uninjured; no weight has

been found. The safety valve, after ascending in the air, fell on the starboard side of the "Storm's" hurricane deck, passing through it and landing among some china ware in the steward's pantry.

r, the steam drum in a perfect cylindrical state, all the connexions being torn off at the joints.

Fig. 3, is 11½ feet of one of the boilers, taken as it lay on the ground; the head remaining, which is of boiler iron, is partly bent and torn; the flue which was on the starboard side is collapsed the whole length of the shell, and it is partly separated from the head. Two feet of the other flue, also collapsed, remains; it is cracked at its junction with the head. The open end of the shell is of an oval shape; nearly all of what was the starboard chock remains as seen; part of the lead forming its joint is *melted* out. No water line is distinct in this piece of the boiler, *but it has unmistakeable signs of its being much heated.* At *s* and *t*, are deep indentations of the line of rivets formed by one of the other boilers, which, coming in contact with its surface, impressed the rivet heads into the shell; in that part enclosed within the hypothenuse of these right angles, the iron is convexing, with a quick curve from the line of indentations. On a part of the shell not seen, being the top when on the boat, are still deeper recesses caused by rivets. The extraordinary appearance of the shell leads me to think that these indentations could only be formed by the iron being very hot, and a great steam pressure within the boiler at the time of contact; otherwise the plates would be concave, instead of having more convexity than is due to the original circle of the boiler.

The "Louisiana," at the time of the explosion, was getting ready to leave, for the purpose of going down to the shipping to take in emigrant passengers. From good information, which the parts of the boiler confirm, the water was very low, and the steam escaping from the weighted safety valve freely. The second engineer, who had charge, ordered the firemen to "open the fire doors," the *doctor was started* to work the pump, and almost instantly the boilers exploded, one after the other in quick succession. Throwing more water into the overheated boilers, may also have been assisted by the "Storm," in landing, coming in contact with the "Louisiana," causing her to list, and surging the water over the highly heated metal, and so *flashing* it into steam. What water fell, was principally in the direction of *h* and *i* of the diagram.

The first engineer was absent on leave, and was, at the time of the explosion, waiting three miles above, at the river, to join the boat when it came up, the engines being left in charge of the second engineer and two "strikers."* The boilers were about six years old; three had been on one boat, and the other was from another boat. The plates ranged above and below one-fourth of an inch in thickness; the parts examined were of medium quality. I should not think that the boilers were deficient in strength for the usual working pressure, (as the great destruction is proof of their strength,) but attribute the explosion to a want of water in one or more of the boilers, and the practice with many young engineers, especially

* "Striker" is the name given to assistants below the grade of second engineer. Sometimes these are men having a full knowledge of engineering, but the low rate of pay does not ensure much efficiency.

with a new boat, of overloading the safety valve at the landing, for the purpose of "showing off" in passing the city front.

The position of the furnace of the boilers I believe has a tendency to produce danger. If the furnace was *aft*, then the engineer could at all times know the exact state of the fire without leaving his post at the engine, and by his better judgment regulating the quantity of fire, so as to *avoid* the blowing off of steam, and with it the useless waste of water in the boilers; as arranged now, he must go from 30 to 40 feet, to know *correctly* how his fire is. Custom is the only obstacle to a change which would be found to be more economical, and safer.

P. S.—An investigation in secret, by the Coroner, and a public one by the United States Commissioner, has been going on, examining into this explosion. Up to this date, nothing has been elicited to change what I have written, but much has been confirmed by the witnesses, with the exception of one, who states in substance that the two engines were in rapid motion, (all my information was to the contrary,) and the boat kept moving against and from the wharf. I think this opinion must be erroneous, for if the boat was oscillating, no part of the boilers could have got overheated. I once was in a bad fix with a locomotive, on the extreme end of the track, being compelled to keep up the steam to back the train 1½ miles, and knowing the water, from foaming much, was low. I kept the locomotive moving, by steam, to and fro about four feet, (all the room I had,) till the passengers were out, and then backed up. By this means, the brass flues were kept moist, and were uninjured; only 22 gallons of water remained in the boiler.

New Orleans, November 24, 1849.

For the Journal of the Franklin Institute.

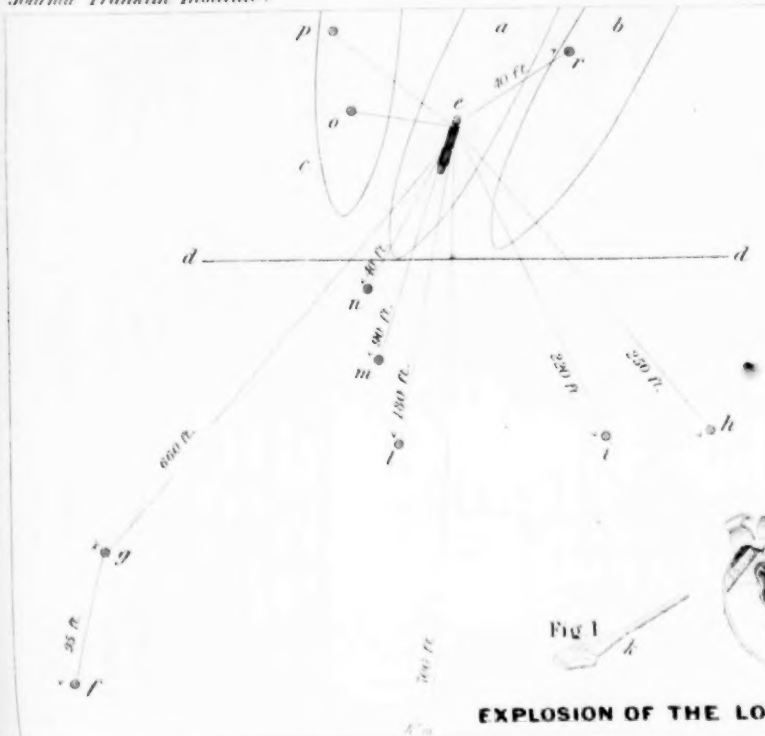
Notice of a New Rotary Engine.

A large steamer, intended for the Hudson river, has just been launched in New York. She is 350 feet long, and is to be fitted with a rotary engine, having a cylinder 16 feet diameter; the wheels are attached direct, and are 40 feet in diameter. This vessel is owned by Messrs. Thompson & Hicks, of that city, who are determined that no expense shall be wanting to perfect her machinery, which is being constructed at the West Point Foundry, which is a sufficient guarantee that it will be well executed. We hope they will obtain the success they deserve, although, from the repeated failures that have been made, the case appears a bad one.

For the Journal of the Franklin Institute.

Mode of Grinding Spherical Surfaces. By Erskine Hazard, Esq.

While reflecting on the operation of Bogardus' mill for triturating or pulverizing hard substances, it struck me that the same principle could be applied to the grinding and polishing of either plane or spherical surfaces, such as mirrors or marble slabs, or the different kinds of optical glasses



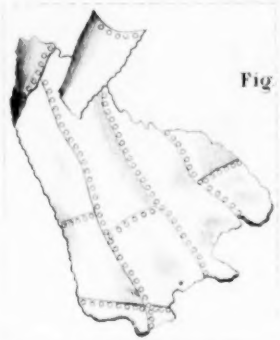


Fig. 2.

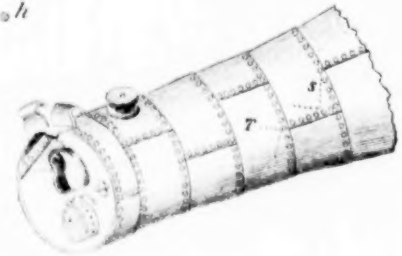


Fig. 3.

EXPLOSION OF THE LOUISIANA.

and reflectors. I send you a sketch of both applications, the figures having the same letters attached to the corresponding parts of both.

a a are parts of a frame, to which brasses are attached, for the spindle *f* of the mill to turn in, and to slide downwards as the grinding progresses. *b* is the pulley for the strap or band to work on; *c* the upper runner, to which one of the flat plates, or a lens, or set of spectacle glasses, is to be attached; *d* the lower runner, which turns upon a spindle in the socket *e*. *d* may have a piece or pieces attached to it, to be ground either flat or concave, or may be a mere friction surface to operate on the pieces attached to *c*.

Fig 1.

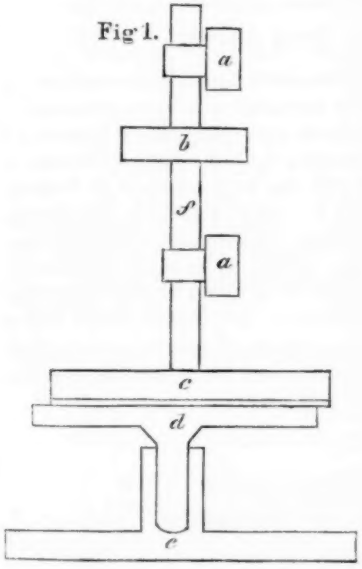


Fig 2.

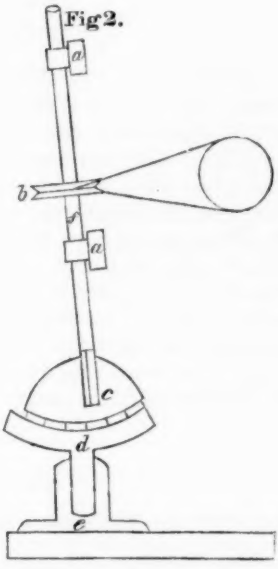


Fig. 1 has the spindles of both the upper and lower runners parallel to each other, but eccentric. The surfaces of the runners must therefore work at right angles with their spindles, and both in the same line, their eccentricity constantly bringing new surfaces in contact as the lower runner is turned by the friction of the upper. It will, therefore, grind perfectly flat.

In fig. 2, the spindles are not only eccentric, they also are not parallel. The surface of each runner will move at right angles with its spindle, the upper one turning the lower one, as in fig. 1, and bringing new surfaces in contact, they cannot fail to cause a truly spherical surface.

In grinding lenses upon the ordinary plan the spindle is concentric with the hollow grinder, which is stationary, and the motion of the block with the glass attached to it, is communicated by a crank on the spindle, which passes into the block and gives it a circular motion round the grinder, at the same time that it turns on the crank by the friction of the grinder. The motion must necessarily be slow, and sphericity cannot be depended

on. On the plan I propose, any motion may be given without affecting the result, and glasses may be ground to much less spheres than can be made with a crank. It will, therefore, have the advantage of expedition and truth, and produce glasses of higher magnifying powers, while it is equally applicable to the manufacture of the largest lenses or reflectors.

The lower runners can have a raised rim projecting from them, to contain the necessary water or oil, with the cutting or polishing substances. It is evidently immaterial whether the power is applied to the upper or lower spindle.

For the Journal of the Franklin Institute.

The Economy of the Steam Engine.

Since the time of Watt, many improvements have been made in the steam engine, some of them being directly intended to increase its economy, while others have been devoted to its form and proportion; but while a great deal has been done, much (particularly in this country) remains to be done. In Cornwall, one pound of coal has been made to do twice as much as Watt was able to perform with it. In this country, the average performance is below that obtained by him. I propose, in a future number, to show the reason why we do not obtain as good a result as we should, and to point out the proper means to be taken to obtain a higher effect than is ordinarily obtained. I will state, in advance, that *I have no patented improvements* to introduce, but wish to show that we all much neglect the means we have at our command, and are paying no attention to the maxim that a penny saved is a penny earned. W.

For the Journal of the Franklin Institute.

Particulars of the Steamship "Philadelphia."

This fine steamer having recently sailed on her first trip to Havana, I send you the following particulars relating to her construction and performance. She is 200 feet long on deck, 33 feet wide, and 18 feet 3 inches deep, and her hull has been built in the best manner by Messrs. Vaughan & Lynn, from the model furnished by Mr. Thompson, President of the Steam Navigation Company, and she has been much admired for her beauty, as well as for the light draft of water obtained.

Her machinery was began by Messrs. Merrick & Towne, and finished by their successors, Merrick & Son. It consists of two side lever marine engines, with cylinders of 56 inches diameter and 6 feet 9 inches stroke. Water wheel, 27 feet diameter; paddles, 8 feet 6 inches long, and 30 inches deep, and with 200 tons of coal on board they dip under 18 inches; without coal they have but 30 inches dip. Each wheel contains 24 paddles, and the whole 30 inches is placed on one side of the arm, not split, as is usually done. The boilers, two in number, are 26 feet 10 inches long, 12 feet 6 inches wide, and 8 feet 8 inches high, having 4 furnaces each, with grates 7 feet long. Anthracite coal, with natural draft, is used, and found to generate an ample supply of steam. On her trial, the en-

gines made as high as 22 revolutions, and gave an average of 19 with 13 inches of steam, cutting off at half-stroke. The engines are fitted with Sickle's adjustable cut-off, which gave much satisfaction.

On the trip to Charleston, she made the run under steam, to Cape Hatteras, in 27 hours, while from there to Charleston Bar, she was 51 hours, caused by a severe gale of wind ahead, the severity of which may be judged when, during its continuance, a speed of 4 miles per hour was the most that could be obtained, carrying 16 inches of steam and working full stroke. The "Southerner," bound from Charleston to New York, laid by 24 hours behind her time, although the wind would have been with her.

The "Philadelphia" is the first side wheel sea steamer built at this port, and her builders may well be proud of their success; she will give them credit wherever she may go. If our merchants had a portion of that enterprise which distinguishes our sister city, New York, the time would soon come when we would have regular lines to Charleston, Havana, New Orleans, Liverpool, and Havre. Until they attempt to divert the stream, they must be satisfied with such trade as may happen to fall to their share.

B.

On a Formula for Calculating the Expansion of Liquids by Heat. By William John Macquorn Rankine, Esq., *Civ. Eng.**

Having been lately much engaged in researches involving the comparative volumes of liquids at various temperatures, I have found the following formula very useful:

$$\text{Log. } V = B\,t + \frac{C}{t} - A$$

Log. V represents the common logarithm of the volume of a given mass of liquid, as compared with its volume at a certain standard temperature, which, for water, is the temperature of its maximum density, or 4°·1 centigrade, and for other liquids 0° centigrade.

t is the temperature measured from the absolute zero mentioned in my paper on the Elasticity of Vapors, in the Edinburgh New Philosophical Journal, for July, 1849, and is found by adding 274°·6 to the temperature according to the centigrade scale.

A, B, and C, are three constants, depending on the nature of the liquid, whose values for the centigrade scale, corresponding to water, mercury, alcohol, and sulphuret of carbon, are given below.

	A.	Log. B.	Log. C.
Water, . . .	0·4414907	$\overline{4}$·8987546	1·7890286
Mercury, . . .	0·0229130	$\overline{5}$·9048766	$\overline{1}$·3703897
Alcohol, . . .	0·2615033	$\overline{4}$·8414452	1·2893056
Sulphuret of Carbon,	0·2540074	$\overline{4}$·8483872	1·2192054

The data from which the constants have been computed have been taken from the following authorities:—for water, from the experiments of Hallström; for mercury, from those of Regnault; and for alcohol and sulphuret

* From the Edinburgh New Philosophical Journal, for October, 1849.

of carbon, from those of Gay-Lussac. As the experiments of M. Gay-Lussac give only the apparent expansion of the liquids in glass, I have assumed, in order to calculate the true expansion, that the dilatation of the glass used by him was ·0000258 of its volume for each centigrade degree. This is very nearly the mean dilatation of the different kinds of glass. M. Regnault has shewn that, according to the composition and treatment of glass, the coefficient varies between the limits ·000022 and ·000028.

Annexed are given tables of comparison between the results of the formula and those of experiment. The data from which the constants were calculated are marked with asterisks.

The table for water shews that, between 0° and 30° centigrade, the formula agrees closely with the experiments of Hallström, and that from 30° to 100° its results lie between those of the experiments of Gay-Lussac and Deluc.

The experiments of Gay-Lussac originally gave the apparent volume of water in glass, as compared with that at 100°. They have been reduced to the unit of minimum volume by means of Hallström's value of the expansion between 4°·1 and 30°, and the coefficient of the expansion of glass already mentioned.

In the fifth column of the table of comparison for mercury, it is stated which of the experimental results were taken from M. Regnault's own measurements on the curve, representing the mean results of his experiments, and which from his tables of actual experiments, distinguishing the series.

In the experimental results for alcohol and sulphuret of carbon, the respective units of volume are the volumes of those liquids at their boiling points, and the volumes given by the formula have been reduced to the same units.

Expansion of Water.

Temperature on the Centigrade Scale.	Volume as compared with that at 4° 1 C. according to		Difference between Calculation and Experiment.	Authorities for the Experiments.
	the Formula.	the Experiments.		
0°	1·0001120	1·0001082	+ ·0000038	Hallström.
*4·1	1·0000000	1·0000000	·0000000	Do.
10	1·0002234	1·0002200	+ ·0000034	Do.
20	1·0015668	1·0015490	+ ·0000178	Do.
*30	1·0040215	1·0040215	·0000000	Do.
....	....	1·0041489	— ·0001221	Deluc.
40	1·0075000	1·0074800	+ ·0000200	Gay-Lussac.
....	....	1·0077400	— ·0002400	Deluc.
60	1·0171800	1·0167000	+ ·0004800	Gay-Lussac.
....	....	1·0177300	— ·0005500	Deluc.
80	1·0300700	1·0286500	+ ·0014200	Gay-Lussac.
....	....	1·0309200	— ·0008500	Deluc.
100	1·0457900	1·0429000	+ ·0028900	Gay-Lussac.
....	....	1·0466400	— ·0008500	Deluc.

Expansion of Mercury.

Temperature on the Centigrade Scale.	Volume as compared with that at 0° C. according to the Formula.	Volume as compared with that at 0° C. according to M. Regnault's Experiments.	Difference between Calculation and Experiment.	Remarks.
• 0°	1·000000	1·000000	·000000	Curve.
90·22	1·016333	1·016361	— ·000028	Series I.
100·00	1·018134	1·018153	— ·000019	Curve.
100·52	1·018230	1·018267	— ·000037	Series I.
•150·00	1·027419	1·027419	·000000	Curve.
198·79	1·036597	1·036468	+ ·000129	Series II.
205·07	1·037786	1·037805	— ·000019	Series IV.
205·57	1·037905	1·037910	— ·000005	Series III.
•300·00	1·055973	1·055973	·000000	Curve.

Expansion of Alcohol.

Temperature on the Centigrade Scale.	Volume as compared with that at 78°·41 C. according to the Formula.	Volume as compared with that at 78°·41 C. according to M. Gay-Lussac's Experiments.	Difference between Calculation and Experiment.
3°·41	·91795	·91796	— ·00001
•18·41	·93269	·93269	·00000
33·41	·94803	·94799	+ ·00004
•48·41	·96449	·96449	·00000
63·41	·98183	·98210	— ·00027
•78·41	1·00000	1·00000	·00000

Expansion of Sulphuret of Carbon.

Temperature on the Centigrade Scale.	Volume as compared with that at 46°·60 C. according to the Formula.	Volume as compared with that at 46°·60 C. according to M. Gay-Lussac's Experiments.	Difference between Calculation and Experiment.
•— 13°·40	·93224	·93224	·00000
+ 1·60	·94768	·94776	— ·00008
• 16·60	·96417	·96417	·00000
31·60	·98163	·98163	·00000
• 46·60	1·00000	1·00000	·00000

*Coals for the Steam Navy.**

We have received the second report on this interesting and important subject, by Sir Henry De la Beche, C. B., F. R. S., and Dr. Lyon Playfair, F. R. S., just presented to both Houses of Parliament. These reports embody the results of a long series of experiments, made at the request of the Lords of the Admiralty, at the laboratory of the Museum of Economic Geology, on a large number of specimens of coal from all parts of the kingdom, and on some foreign coal, on some manufactured fuels, and on coke. The main points of inquiry have been—the evaporative value of the fuel, its mechanical structure, bulk or space occupied in stowage, and the chemical construction of the fuels experimented on.

We are informed in the report that each coal was subjected to experiment for three successive days, the draft being differently arranged for each day; by these means it became easy to ascertain when the gases escaping from the coals were most economically consumed. The mean of the three days gives more correctly the average evaporative value in steam vessels, where the exact draft depends in a great measure on circumstances over which the engineer has little control. The coals most liable to be influenced by different adjustments for the admission of air are those which, from their bituminous characters, are most apt to generate a large quantity of gaseous products on the first application of heat, such as those from the Northumberland, Durham, and Lancashire coal fields; and these, under different areas for the admission of air, vary much more than with the less bituminous kinds of the South Wales field; and in the highly gas-giving coals, as the Cannell coal of Wigan, it was found necessary to admit air behind the bridge, to complete the combustion of the escaping gases.

In experiments to ascertain how far mixtures of anthracite with bituminous coals were likely to prove advantageous in the manufacture of artificial fuel, the apparatus patented by Mr. Warlich, and now used in the dockyards, was placed at their disposal, and the various mixtures were tried under the boiler. It was, however, ascertained that the advantages of these additions was not such as to recommend their adoption. The cementing tar, although partially carbonized by the heat of the coking ovens, was so much more combustible than the dense and difficultly burning anthracite, that the latter remained unconsumed after the combustion of the former, accumulating on the bars in a state of powder, obstructing the draft, or falling through the grate and escaping combustion.

The coals on which experiments were made were selected with the greatest care; inquiries were made at the different ports, as to the kind of coal exported for steam purposes, information from steam navigation companies was obtained, and the local character of the fuel ascertained. Circulars were then forwarded to the owners of such coals, explaining the object, and requesting them to furnish two tons for experiment. In most cases they were sent; some, however, did not comply, and it is therefore probable that many more excellent varieties exist in the several coal fields than are given in Messrs. De la Beche and Playfair's reports. We select from the tables a few of the experiments made, taking the best of each

* From the London Mining Journal, No. 727.

district, the following twelve of which will give an accurate idea of the method adopted of showing their relative values:—

Names of Coals.	Space occupied by a ton.	Weight of a cubic foot.	Water evapor'd by a lb. of coal.	Water evapor'd by a cu. ft.
WALES.	cubic feet.	lbs.	lbs.	lbs.
Thomas's Merthyr,	42·26	53·0	10·16	538·48
Nixon's Merthyr,	43·32	51·7	9 96	514·93
Gadley, 9-feet seam,	40·87	54·8	9·56	523·88
Neath Abbey,	37·77	59·3	9·38	556·23
LANCASHIRE.				
Balcarras Arley,	44·35	50·5	8·83	445·91
Blackley Hurst,	46·66	48·0	8·81	422·88
Blackbrook Rushy Park,	40·50	55·3	8·02	443·50
Laffak Rushy Park,	42·58	52·6	7·98	419·74
NEWCASTLE.				
Andrew's House Tanfield,	42·99	52·1	9·39	489·21
Newcastle Hartley,	44·35	50·5	8·23	415·61
Hedley's Hartley,	43·07	52·0	8·16	424·32
Hasting's Hartley,	46·18	48·5	7·77	376·84

From this table, the twelve descriptions of coal which we select as a specimen, it will be seen that the South Wales coal field produces the best steam coal. It will also be seen that the coal, 1 lb. of which evaporates the most water, is not, as a matter of course, the most economical. For instance, 1 lb. of Thomas's Merthyr evaporates 10·16 lbs. of water, but a cubic foot, weighing only 53·0 lbs., evaporates 538·48 lbs.; while the Neath Abbey, although 1 lb. evaporates only 9·38 lbs. of water, a cubic foot weighs 59·3 lbs. and evaporates 556·23 lbs.; consequently, in evaporating powers, in proportion to stowage, it is the most economical. The same calculations can be made with the others. The following are the chemical constituents of these twelve descriptions of coal:—

Names of Coals.	Specific Gravity.	Carbon.	Hydro.	Nitro.	Sulphur.	Oxygen.	Ash.
WALES.							
Thomas's Merthyr,	1·30	90·12	4·33	1·00	0·85	2·02	1·68
Nixon's Merthyr,	1·31	90·27	4·12	0·63	1·20	2·53	1·25
Gadley, 9-feet seam,	1·33	86·18	4·31	1·09	0·87	2·21	5·34
Neath Abbey,	1·31	89·04	5·05	1·07	1·60	—	3·55
LANCASHIRE.							
Balcarras Arley,	1·26	83·54	5·21	0·98	1·05	5·87	3·32
Blackley Hurst,	1·26	82·01	5·55	1·68	1·43	5·28	4·05
Blackbrook Rushy Park,	1·27	81·16	5·99	1·35	1·62	7·20	2·68
Laffak Rushy Park,	1·35	80·47	5·72	1·27	1·39	8·33	2·82
NEWCASTLE.							
Andrew's House Tanfield,	1·26	85·58	5·31	1·26	1·32	4·39	2·14
Newcastle Hartley,	1·29	81·81	5·50	1·28	1·69	2·58	7·14
Hedley's Hartley,	1·31	80·26	5·28	1·16	1·78	2·40	9·12
Hasting's Hartley,	1 25	82·24	5·42	1·61	1·35	6·44	2·94

A third report will be published, including the remainder of the coals thought necessary to examine; the investigations will continue to be con-

ducted, as before, under the superintendence of Messrs. De la Beche and Playfair, the actual experiments being entrusted to Mr. J. Arthur Phillips. In an appendix to the report, are given the details of each experiment during the three days, the situation, depth, local position, and geological character of each colliery, with copies of the certificates of the owners or agents of the coals under notice, as to their genuineness. The whole forms a most interesting document to those connected with the coal districts, and most important to the Government and steam vessel companies, as guiding them in their choice of a fuel, which, from practical experience, is known will prove the most safe and economical in all long voyages.

On Carbonate of Lime as an Ingredient of Sea Water. By JOHN DAVY, M. D., F. R. S. Lond. & Edin., &c.*

The manner in which limestone cliffs rising above deep water are worn by the action of the sea, as it were by a weak acid, such as we know it contains, viz., the carbonic—the manner, further, in which the sand on low shores, where the waves break, becomes consolidated, converted into sandstone, by the deposition of carbonate of lime from sea water, owing to the escape of carbonic acid gas,—are facts clearly proving that carbonate of lime is, as a constituent of sea water, neither rare of occurrence, nor unimportant in the economy of nature, inasmuch as the phenomena alluded to,—the one destructive, the other restorative,—have been observed in most parts of our globe where geological inquiry has been instituted.

Apart from the economy of nature, the subject under consideration is not without interest in another relation,—I allude to steam navigation. The boilers of sea-going steam vessels are liable to suffer from an incrustation of solid matter firmly adhering, and with difficulty detached, liable to be formed on their inside, owing to a deposition which takes place from the salt water used for the production of steam. On one occasion that I examined a portion of such an incrustation taken from the boiler of the "Conway," a vessel belonging to the West Indian Steam Packet Company, I found it to consist principally of sulphate of lime, and to contain a small proportion only of carbonate of lime. This vessel had been employed previously in transatlantic voyages, and also in intercolonial ones, plying between Bermudas and the Island of St. Thomas, and in the Caribbean Sea and the Gulf of Mexico.

The composition of this incrustation, like the preceding results, would seem to denote, if any satisfactory inference may be drawn from it, that carbonate of lime is in small proportion in deep water distant from land, and that sulphate of lime is commonly more abundant. The results of a few trials I have made, whilst rather confirmatory of this conclusion, showed marked differences as to the proportion of sulphate of lime in sea water in different situations. That from Carlisle Bay was found to contain 11·3 per 10,000. A specimen taken up in lat. 29° 19′ and long. 50° 45′, yielded about 2 per 10,000, with a trace of carbonate of lime. A specimen taken up off Fayal yielded about 9 per 10,000, also with a trace of carbonate of lime. One taken up off Portland Head, about fifteen miles

* From the London, Edinburgh, and Dublin Philosophical Magazine, for September, 1849.

distant, yielded only ·4 per 10,000, part of which was sulphate, part carbonate of lime.

By certain management, I am informed, as by not allowing the sea water in the boilers to be concentrated beyond a certain degree, the incrustation, in the instances of the transatlantic steamers, is in a great measure prevented. Perhaps it might be prevented altogether, were sea water never used but with this precaution, and taken up at a good distance from land, and in situations where it is known that the proportion of sulphate of lime is small. If this suggestion be of any worth, further, more extensive, and exact inquiry will be requisite to determine the proportion of sulphate of lime in different parts of the ocean, and more especially towards land. By the aid of the transatlantic steam navigation companies, means for such an inquiry may easily be obtained; and it can hardly be doubted that the results will amply repay any cost or trouble incurred.—*Proc. Roy. Soc.*

Lesketh How, Ambleside, March 29, 1849.

The Pottery and Iron Floors of Paris. By Mr. Geo. R. Burnell.*

Amongst the improvements made in the art of building since the last "Exposition of Industry" in Paris, one of the most important appears to be the application of wrought iron for flooring purposes. As this mode of employing a material we possess in such abundance, and at such very low prices, is but little known in England, some notes upon the subject may be useful. It is to be observed, firstly, that the practice of building in Paris being rarely to make floors of more than from 20 feet to 30 feet bearing, the notes are to be considered as applicable within those limits, unless otherwise specified.

There are three modes of employing wrought iron: firstly, with wrought iron frames, filled in with hollow pots bedded with plaster. Secondly, the wrought iron frames are filled in with light rubble, also set with plaster. Thirdly, the main joists are made of wrought iron, wood trimmers are introduced, and the whole frame-work is then bound together with tie rods.

Firstly, The use of pottery for flooring purposes is far from being of modern invention; instances being met with in the ancient Roman edifices. The round church of Ravenna has walls and a dome of pottery. But the first attempts made to introduce the use of these hollow materials into general practice appears to have been shortly before the revolution of 1789. About that time the Academy of Sciences of France made an elaborate report upon, and even began some experiments upon the force of resistance of, a system of flooring executed entirely in pots and plaster. Iron was, in those days, too dear to allow of its use in ordinary cases; these floors were therefore cambered. During the empire, and in the beginning of the restoration, the vaults of the spirit cellars of the Entrepôt des Vins were executed with skew backs of solid brickwork, and the arches were filled in with pottery; they were about 18 feet span. In the corridors of the Chamber of Deputies, arches from 26 feet to 27 feet span, panelled, and springing from pendentives, were executed in the same manner, as were also some of the circular-headed niches of the Madelaine.

* From the London Builder, No. 383.

In the palaces of Versailles and the Tuilleries, pottery floors have been executed, the dimensions of which are about 66 feet in length by 33 feet in width. But for the usual dimensions of from 20 feet to 30 feet, the usual course adopted is as follows:—

Framed wrought iron girders (consisting of a chord bar $1\frac{1}{4} \times \frac{3}{4}$, with a bar of the same scantling curved so as to rise about 8 inches in the centre, maintained in their respective positions by clipping pieces, keys, and wedges) are inserted at distances of about 13 feet from centre to centre. An intermediate bar, 2 inches by $\frac{3}{4}$ inch, is placed between the girders, and this frame-work is kept in its vertical position by means of cross ties, which pass over and notch down upon the different beams; the cross ties are of $1\frac{1}{4} \times \frac{3}{4}$. Small square bars are laid upon the top of the cross ties, (of $\frac{3}{4}$ inch square iron,) and split rods, $\frac{3}{8}$ inch square, are laid upon these. In fact, a sort of net work is formed, the intervals of which are about 3 feet square, which is subsequently filled with pottery. This is done upon a centre large enough to take one bay at a time.

The pots used for flooring purposes are of two dimensions—$7\frac{7}{8}$ inches high by $4\frac{1}{16}$ inches diameter, and $8\frac{1}{16}$ inches high by $4\frac{3}{8}$ inches diameter. The upper end is beaten into a sort of octagonal form, but the main body of the pots is cylindrical.

A floor executed with pots $7\frac{7}{8}$ inches high, carried a weight of about $3\frac{3}{4}$ cwt. to the foot superficial before breaking. Another floor, executed with pots $8\frac{1}{16}$ inches high, carried $4\frac{1}{2}$ cwt. to the foot superficial.

The French architects have also employed these hollow materials in positions which have allowed them to economize much room, namely, for partitions and party walls. The police authorities some time since called upon the proprietors of the theatre, then called, of the Palais Royal, to separate it from the adjoining tenements by a wall impervious to fire. This end was effected by building a wall 36 feet long by 66 feet high, with hollow pots $8\frac{1}{16}$ inches long, bedded in plaster and rendered on both sides with the same material. Our Building Act would hardly admit of the execution of a party wall of these dimensions, for, with the two coats of plaster, it is barely 11 inches thick, yet experiments have shown that, for the purpose of intercepting the progress of fire, it is established in the most favorable conditions. So satisfied are the French architects with this mode of employing the hollow material, that in many of the most important modern buildings they have repeated its application; as, for instance, in the Palace of the Quai d'Orçay.

Secondly, The wrought iron floors are sometimes executed with ribs or bars, $6 \times \frac{3}{4}$, built into the walls every 3 feet 4 inches apart, when the spans are about 18 feet. Upon these, cross ties of $\frac{3}{4}$ square iron are laid, and split rods $\frac{3}{8}$ thick complete the net work; the cross ties being spaced about 3 feet 4 inches from centre to centre, the split rods about 8 inches apart. The whole of this framing is then filled in solid with light plaster rubble, floated with plaster; care being taken not to carry the works close up against the walls, or the expansion of the plaster would either force them out, or cause the floor to sink.

Floors executed upon this system were first adopted in the year 1845, about the epoch of the great strike of the carpenters of Paris. They are now becoming of general use; but although they resist the transmission of

fire, they are exposed to the very serious objections of being very heavy, of loading the walls to an unnecessary extent, and of being very expensive. In England, moreover, the absence or want of good plaster opposes an insurmountable objection to the adoption of this system. Cement might be substituted, but that is still, notwithstanding the great diminution in price, too expensive to admit of its use in such great quantities.

Thirdly, A M. Rosier, master carpenter, of Paris, has sent to the Exposition a specimen of a floor, which appears to obviate the objections to the expense of the first system, and the unnecessary weight of the second. Every 3 feet 4 inches apart, he introduces a wrought iron bar, of the shape of an H laid flat, $5\frac{1}{2}$ inches deep; the centre web $\frac{1}{4}$ inch thick, top and bottom flanches $1\frac{3}{4}$ inches wide by $\frac{1}{4}$ inch thick. These bars rest upon the walls, and each alternate bar is tied down with vertical rods. Between these bars, at distances of $19\frac{3}{4}$ inches from centre to centre, trimmers of wood, $5\frac{1}{2} \times 1\frac{3}{4}$, are introduced flush with the under surfaces of the wrought iron bars; and at the side of the trimmers a straining bolt, $\frac{1}{2}$ inch in diameter, is placed to tie the whole system together. The laths and floor boards are fastened to the trimmers, which, at the same time, afford the means of introducing sound boarding and pugging. The wrought iron bars weigh about 29 lbs. to 31 lbs. per 3 feet 4 inches run, or between 13 and 14 kilogrammes to the metre.

These floors are exceedingly stiff, and when covered with tiles, as they commonly are in Paris, they are, for all practical purposes, fire-proof, although certainly not so efficient in this respect as the floors constructed upon the two previously described systems. All the different modes have the great advantage of requiring but little comparative depth. For instance, a floor constructed upon either of the two last named, need not be more than 8 inches thick, flooring and ceiling included, for a span of 20 feet; for a span of 30 feet, 10 inches would be sufficient. A pottery floor of 33 feet need not be more than 13 inches deep, with floor and ceiling.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 20th, 1849.

Samuel V. Merrick, President, in the chair.

Thomas Fletcher, Vice President.

Isaac B. Garrigues, Recording Secretary.

John F. Frazer, Treasurer.

The minutes of the last meeting were read and approved.

Letters acknowledging donations were read from the Royal Society, and the Royal Institution, of London.

A communication was read from Mr. Charles Harkness.

Donations were presented from—William C. Redfield and the American Institute, of New York; I. W. P. Lewis, Hon. Joseph R. Ingersoll, and Edward Ingraham, of Philadelphia.

The Treasurer read his statement of receipts and payments for the month of November.

The Board of Managers and the Standing Committees reported their minutes.

The Committee having charge of the arrangement of the Geological Specimens were excused from reporting until the next meeting.

Resignations of membership in the Institute were read and accepted. (3.)

New candidates for membership in the Institute (22) were proposed, and those proposed at the last meeting (141) were elected members of the Institute.

A communication from Henry Perkins, Esq., submitted at a former meeting, was acted on, and the request was not granted.

The communication from Mr. Charles Harkness, submitted this evening, was, on motion, referred to the Committee on Exhibition, with instructions to report at the next meeting.

On motion, the Annual Election for Officers, Managers, and Auditors, was directed to be held on Thursday, January 17th, 1850, between the hours of 3 and 8 o'clock, P. M., and a committee of seven member were appointed to receive the votes and report the result.

Nominations were made for the Officers, Managers, and Auditors of the Institute for the ensuing year, to be voted for at the Annual Election.

Mr. Merrick presented for examination some specimens of caoutchouc, (gum elastic,) which had been vulcanized according to the process of Mr. Goodyear, and used very successfully for steam packing for pistons. They had been exposed, without injury, to a high degree of heat for ten months. He also exhibited some granulated caoutchouc, the result of constant percussion, when used as a buffer, under a heavy steam hammer for several hours.

The Chairman of the Committee on Meetings, Mr. George W. Smith, stated that during the last Spring, when the various forms of Dioptric apparatus for lighthouses were submitted to the inspection of the members of the Institute, he was enabled to suggest an improvement of which the system was susceptible. This improvement had been, at the time, exhibited to a number of lighthouse engineers and men of science, both in this country and in Europe. As it had been deemed practicable by a number of these gentlemen, he now submitted it to the Institute for examination.

It is known that, *originally*, the cupola, or that part of the apparatus *above* the drum or system of lenses of Fresnel, consisted of mirrors which reflected the light passing upwards towards the horizon. In the *fixed* lights, the zones of mirrors of the cupola have been advantageously succeeded by horizontal Catadioptric rings of glass, refracting and totally reflecting the light uniformly in every azimuth; but in the revolving lights, these mirrors (which are not in harmony with the residue of Fresnel's beautiful system) are still retained, and occasion a diminution of light which might be prevented.

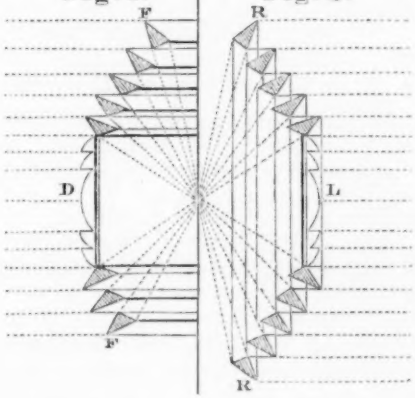
Thus, in fig. 1, (which is the left hand *half* of a vertical section of a Dioptric *fixed* light,) D is the drum, and F F are the Catadioptric *horizontal* rings of the cupola, refracting the light proceeding from the radiant point or lamp in the focus to *every point* in the horizon.

Fig. 2, is the right hand *half* of a vertical section of a Dioptric revolving light, or of a light which is to be thrown only in one direction at the same moment. L is the great annular lens; R R R, the Catadioptric rings ar-

ranged in vertical parallel planes, which unite their beams with those of the great lens, L, and project them in the same direction, without the intervention of the small inclined lenses of the cupola, heretofore used, with their accompanying inclined mirrors. With revolving lights of 8 sides, of course *only segments* of theses rings would be used;—a system of segments for each division of the cupola, as well as for the portions below the great lenses if expedient.*

When a powerful light is required in only one, or in two directions, to mark a channel, *complete* rings will be suitable; the spherical reflectors of Fresnel may be used as auxiliaries. As a few persons have imagined that there is a risk in the employment of a single lamp in the Fresnel lights, the extinction of which would leave the horizon in darkness, and thereby jeopard navigation, although this risk is extremely small, Mr. Smith concluded by stating that, if this improvement of the vertical rings be adopted, four or eight such apparatus, of a smaller size, but of an equal intensity in the aggregate, might be arranged on the the horizontal arms of a Greek cross, each throwing the light in two opposite directions, and the whole revolving; a central fountain supplying the lamp in each apparatus with oil, or each might be furnished with a mechanical lamp, such as Carcel's. If the lamp, with several concentric wicks, consume more oil for a given amount of light than lamps with single wicks, this arrangement might economize the oil, but no opinion is expressed on the latter point. Such small apparatus would require less glass, and have less weight, than those on the plan now in use; the lamps would require no more care than the ordinary fountain lamps; the propriety, however, of substituting a number for the single one now employed, was submitted merely for discussion, without pressing any claim for superiority.

Fig. 1. Fig. 2.



Prof. Cresson remarked that he concurred with the Chairman as to the effects which he had stated to the meeting would result from the adoption of the vertical rings, in lieu of the small lenses and reflectors now in use, and desired that a copy of the plan might be deposited in the Institute, which was assented to.

Mr. Smith proceeded to make some remarks on the usual mode of estimating the economical value of the various methods of illumination, viz., by the intensity of the light, as measured by the photometer, compared with the consumption of material in a given time. He remarked that, although this method was sound in principle if all the circumstances were taken into consideration, yet it frequently led to incorrect conclusions when they were neglected. Thus if a building were to be lighted by a number of

* The rings near the vertical central line are not represented, their section not being in the same plane.

suspended lamps or by gas, suppose the intensity of a given number of the lamps and gas burners, measured as just mentioned, to be equal, the light given by the lamps actually would be less, in some cases, by 14 per cent., in consequence of the interception of a portion of the light by the body of the lamps, whilst, with *suitable* gas burners, little or no light is intercepted. Many gas burners are, however, deprived of this advantage by cups, flowers, or other ornament, injudiciously added beneath the jets.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. B. F. Palmer's Artificial Leg.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred for examination—"An Artificial Leg," invented by Benjamin Franklin Palmer, of Meredith, New Hampshire,—REPORT:—

That the principles and construction of Mr. Palmer's invention are set forth in the annexed drawing and description. The peculiarities of this invention, however, may be stated to consist partially in—

1st, An ingenious arrangement of the springs and cords on the inside of the limb, by which, when the wearer is in the erect position, the limb is extended and the foot thrown forward; whilst, when he is seated, the limb remains flexed, so as to present a natural appearance.

2d, By a second arrangement of springs and cords, on the inside of the limb, the foot and toes are gradually and easily extended when the heel is placed in contact with the ground. In consequence of this arrangement, the limping gait, and the unpleasant noise made by the sudden stroke of the ball of the foot upon the ground in walking, which are so obvious in the ordinary leg, are avoided.

3d, By a peculiar arrangement of the knee joint it is rendered but little liable to wear, and all *lateral* or *rotary* motion is prevented. It is hardly necessary to remark that any such motion in an artificial leg is undesirable, as rendering its support unstable, while the motion in the hip joint is sufficient to make up, in a measure, for the deficiency in the knee.

The pressure of the artificial leg is made uniformly upon the surface of the sides of the stump, and not upon its end, by which arrangement the danger of inflammation and ulceration of the flaps covering the end of the bone, is, in a great measure, avoided.

The Committee have seen one of Mr. Palmer's artificial legs, worn by himself; it is light, well shaped, easily adjusted, and of a surface readily kept clean; the shape of the limb is such as to represent exactly, when clothed, its natural fellow. Mr. Palmer, who has lost his leg just below the knee joint,—which remains flexed at a right angle, stiff and useless,—is enabled, by means of his invention, to walk without a cane, in such a manner as readily to deceive one not acquainted with the facts of the case.

All the natural movements of the limb, except motion laterally, are beautifully executed; he can throw either leg over the other, and can mount a flight of four or five inches with either leg, indifferently, without assistance.

It is deemed proper to state, that Mr. Palmer retains the entire knee

joint, which, although useless to him as such in walking, yet is of importance, inasmuch as the integuments over the patella are little liable to suffer from the strain upon them, caused by the pressure of the instrument on the sides of the stump higher up. The Committee, therefore, are not prepared to give a positive opinion as to the effects of the use of one of his artificial legs on a patient upon whom the amputation has been performed above the knee, and in whom, consequently, the cicatrix must be exposed to more or less tension while wearing the limb. Mr. Palmer states, however, that the leg may be worn over the most tender stump without inconvenience, and that he prefers a stump of from 7 to 10 inches in length.

In conclusion, the Committee would remark, that the artificial leg of Mr. Palmer is superior to any that has yet come under their notice. It is light, strong, beautifully shaped, apparently very durable, self-acting in a greater degree than any they have ever met with, easy and natural in its motions, and possessing apparently all the qualities desirable or attainable in such an invention.

The Committee would recommend the award, to the inventor, of the Scott's Legacy Medal and Premium, and also, to the Committee on Exhibitions, to award to him the First Premium for his model exhibited in the last Exhibition.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

Philadelphia, January 11, 1849.

Description furnished by Mr. Palmer.

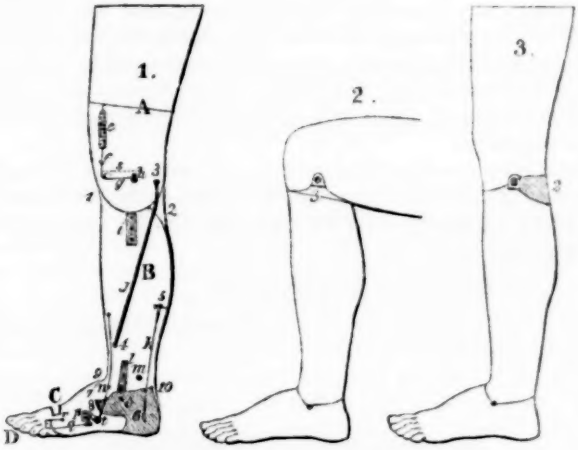
There are four principal parts, viz., the thigh, leg, foot, and toes; see A, B, C, and D, fig. 1. These are usually made of wood, but may be of any other suitable material. The thigh, leg, and foot are hollow, the wood in the interior being excavated, so that only a thin shell or outside is left, making the limb very *light*. The lower extremity of the thigh assumes a hemispherical shape, which may be varied so as to give a correct likeness of the knee it is to mate.

At the junction of A and B, the upper front extremity of B presents a concavity corresponding with the convexity of the lower front portion of the thigh, A, and to the sides of the leg, C, are riveted two metallic plates, of sufficient dimensions to give the articulation the requisite strength. One of these plates, *i*, is fitted to each side of the leg, and fastened in any suitable manner. The tops of these metallic plates pass up a little above the wood, and through them passes a metallic bolt, *h*. Upon one end of this bolt is a flat head, which is countersunk into the side plate; upon the other end is a thread cut, making a screw of it. By means of a slot in the head, this bolt is screwed in to its proper place; in the opposite plate, and with two small screws, which pass through the head and the plate into which it is countersunk, it is fastened so securely that no pressure can start it a hair's-breadth from its fixed position.

This bolt is the axis upon which the thigh revolves, and passes entirely *through* the knee; and the aperture in which it revolves is bushed with any

suitable material, for the purpose of lessening friction and noise. The whole diameter of the knee may bear upon this bolt, or a part of the wood in the interior may be removed from around it, leaving a bearing of not less than *one inch* upon each side.

To this knee-bolt is fastened, in any suitable manner, a lever, *g*, and spring, *f e*. This lever is fastened to, and revolves with, the knee-bolt, is placed horizontally in the vacuum of the thigh, and is acted upon at every motion of the leg by the spring *e f*, which should be so placed as to be at right angles with the lever when the leg is extended.



This spring may be made of vulcanized India rubber, or it may be a metallic coiled or spiral spring. The function of this spring and lever is to make the knee self-acting, or render it capable of extending itself, when flexed, at an angle of 45°, which is about the extent of flexion of the anatomical leg in ordinary walking. When the leg is flexed in the usual sitting position, the thigh being in a horizontal, and the leg in a perpendicular position, (fig. 2,) the spring falls back into a line parallel with the lever, (dotted line *s*.) It is obvious that, in this position, the spring does not act with any considerable force to extend the leg, and it should not, for if it *did*, a continual watchfulness and effort would be required to keep the limb in it proper flexed sitting position.

The front upper extremity of the leg, 1, fig. 1, is beveled to a thin edge, in order to preserve a perfect outline, and is cut away on the rear, 2, so as to give proper motion to the knee. This vacuum is covered, so as to render the exterior perfect, by a piece of flesh-colored wash-leather, 2, fig. 3. In order that you may understand the drawings, I will here say that, in the vertical section, fig. 1, you have an interior side view of all the machinery usually combined in one of my patent legs.

There are two principal tendons, J *k*, one of which fastens to the rear of the thigh and the front of the leg, 3 4, fig. 1, or the lower end may be fastened to the rear of the leg as well as the thigh, or to the foot just forward of the ankle-bolt, *o*. These cords or tendons must be of some flexible

material, very strong, and somewhat elastic, particularly the lower one, which I will now describe.

This tendon, *k*, which is usually made of "cat-gut," fastens to the rear of the leg in any proper and convenient manner, 5, and to the heel, 6. These are new and very important principles, and upon their action depends the utility of the leg in a great degree. The function of the tendon, J, first mentioned, is to stop the action of the knee at a proper time. It arrests and stops the forward motion of the leg, as soon as the foot has passed sufficiently far forward for the limb to stand securely. By means of this tendon, we avoid the necessity of having the leg and thigh come in contact with each other, as in the "Anglesea leg," and others which have the tenon and mortise joint. In those legs, the concussion of the parts at the knee produces a most disagreeable jarring sensation, and thumping sound, which are entirely avoided in my substitute. The function of the other tendon, *k*, is to stop the flexion of the angle at a proper time, so as to give a firm bearing upon the ball of the foot at each step, to keep the front lower extremity of the leg, 7, from coming in contact with the foot, 8, and to act conjunctively with the other tendon in regulating the action of the knee joint, and giving a life-like elasticity to the entire limb. Aided by these cords, the knee and ankle are as firm as the natural articulations of the human limb. The wearer steps fearlessly and easily, and the joints have a nature-like elasticity and flexibility.

The metallic parts of the ankle are precisely like those of the knee inverted. The plates, *l*, are riveted, one to each side of the leg, and pass down upon the sides of the foot a little below the leg. Through them, and to them, passes and fastens the angle-bolt, *o*, in the manner before described. This bolt passes through the entire width of the foot, and revolves in a suitable bushing.

The shape of the foot and ankle may be fashioned exactly like the natural ones. The lower front extremity of the leg is an arc of a circle, of which the ankle-bolt, *o*, is the axis. The instep overlaps this arc of the circle, and is beveled to a thin edge, 9, so as to preserve a perfect outline, and overlaps the circular portion of the leg sufficiently far, so that, in flexion and extension, no opening is presented about the joint. The rear lower portion of the leg is also beveled to a thin edge, 10, and overlaps and passes down upon the heel. The extremity of the heel, as far down as the leg overlaps or passes, is also an arc of a larger circle than the one above referred to, and the ankle-bolt is its axis. The parts which overlap move very closely to those which they encase, but do not touch, 9, 10, (1 at knee.) A pin or bar passes through the leg from inside to outside, *m*, which limits the motion of the ankle in extension, by coming in contact with the heel, but the heel does not strike this pin in ordinary walking. On a line parallel with the ankle-bolt, and about in the centre of the foot, a pin passes through, around which a spring, *p*, is coiled. This spring is a continuous wire, the centre coils of which are brought together in such a manner as to form a loop, and pass down perpendicularly towards the bottom of the foot. Through the loop in this arm of the spring passes a gut cord, *g*, and fastens to the bottom of the toes. This arm of the spring, and the cord, regulate the action of the toe joint, and keep the toes at all times in their proper position. In all other artificial feet, there is a con-

stant tendency in the toes to remain elevated, which give a peculiarly artificial appearance, by which the false limb is at once detected.

The outer coils of the spring above mentioned are carried backward and a little downward, constituting another arm, *t*, of the spring. The two ends of this spring are brought together and fastened in a suitable manner, making the spring a continuous wire. To this arm of the spring a cord, *w*, fastens, and, passing up through an aperture in the foot, fastens to the front portion of the leg. This arm of the spring, and cord, regulate the action of the ankle, keeping the foot at all times in a proper position for stepping. Without this, the anterior portion of the foot would drop to the ground, making the step awkward and laborious.

The toes fasten to the foot by one common joint, *r*, but each toe is wrought out in perfect shape, so that on the exterior they appear as though each had a separate joint. A semicircular groove is made across the piece which constitutes the toes, to which the foot is nicely fitted. Through the centre of the circular portion of the foot, which is adjusted to the groove in the toes, *r*, passes a strong metallic wire, which is bent at the sides of the foot and carried forward through the centre of the toes, and to them fastened in a suitable manner. This joint, aided by the foot spring, resembles in all respects the appearance and action of the natural toes, and gives perfect shape to the boot.

The entire exterior is neatly covered with flesh-colored leather, which is drawn so tensely, and fastened so indissolubly, as to give great additional strength to the limb. This covering is coated over with a cement or varnish which I have prepared expressly for this purpose. The varnish is perfectly impervious to water, and presents an enamelled surface and beauty of color which is only rivalled by the exquisite beauty of the human limb.

As will appear in the foregoing specification, the exterior of the limb assumes the exact shape and proportions of the anatomical one, presenting no unsightly gaps or excrescences for the destruction of apparel, &c. The parts which are *new*, and by me *patented* in the *United States* and *Europe*, comprise *very nearly the whole limb*, viz., the *knee*, *ankle*, and *toe joints*, including the *peculiar shapes* of the wood about them, as well as all the metallic parts of the same; the *spring* and *lever* in the thigh; the foot spring, and all the various improved plans of fastening and arranging the various *cords* and *tendons*, as herein described and shown. I have many other new principles, which are frequently used in fitting legs to peculiarly shaped stumps, which it is not necessary to mention at this time.

This kind of leg may be fitted as well below as above the knee, by leaving off all above the knee, 3, fig. 2, and the tendon, *j*. The weight of the wearer is supported by an even pressure of the socket upon the walls of the leg or thigh, above the place of amputation, so that, though the end of the stump may be very tender, yet the leg may be worn with ease. It may be attached to the stump in any of the known and proper forms.

This kind of leg and foot are *lighter*, *stronger*, and more *durable* than any other hitherto known. It is more flexible and elastic, and retains the power of self-action, the utility of which must be obvious. Friction, in it, is reduced to the lowest possible degree, and the articulations are not subject to contraction and expansion.

COMMITTEE ON EXHIBITIONS.

Address Delivered at the Close of the Nineteenth Exhibition of American Manufactures, held by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, October, 1849. *By* Hon. John K. Kane.

The Committee on Exhibitions have honored me with an invitation to make an address to you this evening, and I have not felt myself at liberty to withhold so humble a contribution to the cause of which our Institute is the eldest American representative. Yet, I am sensible that their selection has not been a happy one; for the course of thought and reading, to which a sort of necessity has addicted me for some years past, has been too exclusively professional, to allow me the hope of engaging the favorable attention of a mixed audience.

Limited from this cause to a narrow range of topics, I have concluded to offer you a few remarks on the apparent imperfections of our system of Patent Laws,—those laws, which have for their object to protect and reward improvements in the useful arts. The number of such improvements, which must have attracted your notice in the present exhibition, may perhaps invest this subject with a certain degree of interest.

The policy, as well as duty, of returning to inventive genius a fair compensation for the benefits it has conferred upon society, is not in our times a topic for argument. In other countries, its recognition may emanate from what is still called Royal Prerogative, but which is in truth only a trust, held in the name of an individual, for the benefit of the many,—or it may be referred more directly to the popular sense of expediency and justice, as expressed in acts of occasional legislation,—but among civilized states, it is known everywhere, sometimes as a boon of power, more frequently as a right. In our own land, it is expressly declared to be among the powers of Congress, "to promote the progress of science and the useful arts, by securing, for limited times, to authors and inventors, the exclusive right to their writings and discoveries."

The earliest patent law of the United States was passed by the first Congress that assembled under the Constitution. It was almost of course imperfect; for in the year 1790 no foreign nation had matured a system of provisions on the subject, from which ours could be profitably copied. Nevertheless it was a good law, and contrasted favorably with the law of England of that day: indeed, I have sometimes doubted whether, brief as it is, it does not furnish a better basis for the system than any of those which have followed it. But be this as it may, the legislation of more modern times, if less perfect in its outline, has been progressively more and more liberal in its details; and the Courts of Justice have contributed, by the increasing liberality of their interpretations, to amplify the benefits of the system.

Yet it is still far from perfect: neither the patentee nor the public derives from it the full and appropriate measure of security and benefit. The author of a meritorious invention finds himself, not unfrequently, made poorer

by the letters patent that profess to reward him; and the mechanical community is infested by swarms of impostors, who bear an apparent title, under the patent laws, to levy arbitrary exactions upon industry.

Let me explain how this happens. An ingenious man has invented a labor-saving machine, and obtained a patent for it. He has begun to use it himself, and has sold licenses to others. It is a highly useful machine, we will suppose,—producing, it may be, an entire revolution in some branch of art; its usefulness universally admitted, by the unanimity with which it is adopted among his brother mechanics. It is, in a word, just the sort of invention that confers on society the highest benefit, and for which society is most anxious to reward him abundantly.

Now, just in proportion as his invention is valuable, just in that proportion is the temptation to defraud him of it. The invention is at once pirated: litigation follows; for his exclusive title is worthless, unless vindicated;—and in this litigation, all who have invaded his rights, and all who have an interest in breaking them down, present a combined front against him.

Libraries are rummaged, to find in ancient books, dreamy, half-formed, unpractical notions, bearing more or less of the same complexion with the matter of his invention;—witnesses come from every quarter, to tell of contrivances, like his in all but usefulness, that were once upon a time put together, in some rude imperfect mechanism, in some out of the way place,—and then abandoned;—old machines, that were in the Patent Office before it was burnt, come out from their ashes, refined, improved, gifted with new vigor, by the imaginative memory of old men when talking of things of the olden time;—scientific theorists are called in, (and there are many such, as impracticable as they are honest, who can see nothing new in any new combination of known agents,) to puzzle us with their arguments, and to demonstrate, that as the lever, and the pulley, and the inclined plane, and the wedge, and the screw, are the cardinal elements of the patented machine, and as in fact it consists of nothing else, therefore the invention has no novelty, and the patent is void.

The poor inventor sits all this time in the Court-room, flushed and fevered, wondering much, and indignant, perhaps, as he hears that the invention, on which he has been wasting his strength and his fortunes for a life-time, was known to all the world before he began, though no one thought of using it till he took out his patent, and every one uses it now.

But he has his witnesses also, his books, and his theorists,—and, peradventure, he has been too poor, or too wise, to retain the ownership of his patent right, and having sold it out to some corporation or some capitalist, he has become disinterested, and may be a witness himself, to detail in person the story of his invention.——

The story has been told; and his case is now in the hands of his advocates,—skilful and conscientious men, who have sought to master the subject, and have succeeded in so far reviving their college recollections of mechanical science, as to understand and explain the merits of their client.

Their first business is to teach the Judge his lesson; and this, if we may admit the testimony of the gentlemen of the Bar, is not always an easy one. There are few of us, indeed, that hold the Judicial place, who

must not confess our alienation from all other sciences except our own. The Law is a jealous mistress, that tolerates no divided affections or pursuits among those who aspire to her favors.

But let us suppose this difficulty overcome; and that the Judge has succeeded, during his intervals of leisure, as we term the languid intermissions between the exhausting sessions of his daily Court, in studying as many treatises of mechanics as are indispensable to a knowledge of the subject. The next thing is to enlighten the Jury,—twelve men, gathered by lot, from the streets and the by-ways, to render unanimous verdicts upon oath,—unlearned men, whose office is to determine and apply scientific truths, when the learned disagree,—arbiters of art, often without one particle of instruction in its simplest dialect.

They retire to their Jury-room; and there, without books to enlighten them, but with an occasional newspaper, perhaps, to lead them astray by some distorted view of the evidence, or some ignorant commentary upon it, they begin their consultations for unanimity,—stimulated not a little by the narrow comforts of a closely locked apartment, their "parlor, kitchen, and hall," on the floor of which, when night comes, they are permitted to spread their mattresses, and dream of that admirable Procrustean device, the boast of Anglo-Saxondom, which claims to expand one conscience and contract another, till they shall coincide. If, under circumstances so favorable to a harmonious conclusion of their labors, they obstinately refuse to think alike, they must be discharged at last;—and the whole affair, with its witnesses, and books, and theories, its expenses and excitement, is to be begun over again, and again, and again,—until twelve "sober and judicious men" are found, to concur in the same "true verdict" upon their oaths.

For the sake of hurrying through this detail of incidents, with which all of us are familiar, let me imagine at once that a verdict has been rendered,—that it is in favor of the patent-right,—and that the Judge is so far satisfied with it, as to refuse the defendant's motion for a new trial,—and that there is besides no legal excuse for submitting the final judgment, by writ of error, to a Court of Review. The patentee has triumphed,—in one cause,—against one defendant,—in one judicial district. Each new defendant, each new cause, opens anew the whole question of the originality of his invention;—and for each succeeding trial, in each of the thirty odd judicial districts of the United States, from New Hampshire to Texas, between Cape Cod and San Francisco, the patentee is to come prepared, with all his testimony, to encounter the same vexations, and abide the same hazard.

Is this the just and politic reward of inventive talent, for its self devotion to the public benefit?—I have seen men, over and again, who had grown grey in litigation and penury, by seeking to vindicate for themselves the rights, which the faith of the Government was pledged that they should enjoy. I have known a patent, among the most meritorious that have done honor to our country, which, after the lapse of more than twenty years, had produced nothing to the inventor but barren praise and substantial wretchedness, still continuing to "hold the word of promise to the ear, and break it to the hope."

On the other side, I have said, that the present patent laws do not se-

cure to the public its just and stipulated share of advantages. Under the law now in force, inventions undergo a much more careful scrutiny before the patent issues, than used to be the case. But there are, nevertheless, numerous patent rights in existence, which are without essential merit; and which recoil from judicial scrutiny, either because of a want of originality in the patentee, an imperfect developement of his alleged invention, or some other less innocent, as well as less apparent, defect of character.

The owners, or alleged owners, of these patent rights, are found, from time to time, in the neighborhood of our manufacturing establishments, denouncing infractions of their rights, threatening injunctions in Equity, and suits for damages at Common Law,—but winding up, generally, with propositions for an amicable adjustment, on terms mutually advantageous. Like the applicant for office, that Mr. Madison used to tell of, who began by asking for the emoluments of Secretary of the Treasury, but condescended afterwards to an Inspectorship of the Customs, and closed by soliciting a pair of cast off breeches, these gentlemen become progressively more reasonable as their proffers are refused, and are for the most part content at last to accept, as a black-mail compromise, an amount somewhat smaller than would pay the expenses of a defence against them.

There is, indeed, no effective method, under our present patent laws, for testing the validity of an asserted patent-right, without first violating it, and thus encountering the hazards of a suit for damages. You cannot compel the patentee to come forward, and sustain his right before-hand: on the contrary, the law almost invites him to lie by, and await infractions; as a spider waits for flies to infringe upon the fabric of his ingenuity, and only proves his strength after he has secured a victim to feel it.

You see, at once, what a dangerous power this leaves in the hands of an unprincipled patentee,—how effectually, by the mere semblance of a patent-right, he may deter others from the use of processes or of machinery, to which he has no exclusive right in fact;—since few men are sufficiently confident in their own opinions, or in the opinions of others, to invest large amounts of capital in a business, of which the legality may be disputed, and which, if deemed unlawful by a Court of Justice, may be afterwards arrested by injunction, or mulcted in exemplary damages.—And thus in the result, the public is restrained from the use of inventions, which are in truth public property; having either been patented imperfectly, or fraudulently, or never patented at all by the real inventor.

There may be, and no doubt there are, other defects in our system of patent laws; but these, which I have indicated, are among the most obvious and important. They are, besides, as ancient as the system itself, and have contributed from the first to impair its popularity as well as usefulness. We have all of us known ingenious men, who refused to patent their discoveries, preferring rather to retain a precarious and difficult, but exclusive enjoyment of them, by working in secret; and there are very few mechanicians, who have not been indignant at the frauds to which the patent laws made it their policy to submit.

The injury, which is retorted upon society by this imperfect protection of meritorious inventors, is more extended and full of consequences than it appears to be at first. The man who withholds an important discovery from the world, does not make others poorer, in merely the same degree,

in which he hopes to enrich himself. He limits the circle of useful art, to which the ingenious suggestions of other minds might have expanded his invention. He holds back from his fellows, that strong incentive to progress, the knowledge of what another has achieved. He buries the talent, which should have yielded increase. He is eating the seed wheat, which should have ministered to the abundance of future harvests.

Yet, it would seem as if these defects were none of them really inherent in a system for the protection of inventive genius;—though the remedy for them might, perhaps, involve some startling changes in our venerable forms of forensic procedure.

No one who has studied political history, can undervalue the Trial by Jury, as a safeguard of popular rights. But I have not yet found the frank and well-practised jurist, who would be content to trust to its arbitrament an issue, involving large familiarity with science, acute analysis, or continuous reasonings.

The metaphysics of Social Life, which we denominate the Law, rarely challenge more refined and intricate discussions, than some of the questions which arise under our Patent Laws. The difficulty, which embarrasses the learned in both sciences, is found, not in determining upon those abstract truths, which we call fundamental principles, and which to them are always simple, if not obvious,—but in selecting out from the mass of such truths, those which apply most directly to the particular case, and then in assigning to each its appropriate share of influence or control:—and a weary difficulty it often is, even for the best of us. But what must it be for those, whose minds have undergone no special training in science,—for whom there are no axioms, no starting points in argument, no definitions, no vocabulary, no alphabet even!—For, we think in words; and cannot begin to reason, till we have been instructed in the language of argument.

Imagine the feeling of a conscientious juryman, who is required to decide a question upon his oath, while he is absolutely ignorant of the very terms in which the question is expressed!—and imagine, too, what confidence, what hope even, there can be for a party, that his rights will be understood and established by any action of twelve such jurymen!—Except to compute the damages which a patentee has sustained, after his claim to damages has been made out, it is often difficult to apprehend what possible good office is to be rendered by a jury in a patent cause. Does it not savor of the grotesque, to call upon such men as compose our juries, to consider of the scientific controversies of chemists and mechanicians,—to follow Professor Henry perhaps upon inductive electricity, in some dispute between the telegraphs,—or to analyze the merits of Mr. Tilghman's method for the alkaline chromates!

Now, why should this be?—Why not refer these questions to men who understand them, or at least to men who can be taught to understand them? When the English Judge of Admiralty is required to pass upon a dispute involving nautical skill, he calls to his aid experts in the art of navigation, ancient masters of the Trinity House, and is indoctrinated by their counsels:—In the same manner, the Judge of a similar Court in our own country invites two or more experienced shipmasters to hear the evidence and arguments with him, whenever the question is one that appeals to a know-

ledge of seamanship and the sea:—And so far as I have heard, decisions made under such circumstances have in every instance satisfied the nautical community;—if even they have not had the more extraordinary good fortune of convincing the parties to the litigation.

They have applied a similar practice in France, to the determination of legal disputes, between the holders of patent-rights, and those who are accused of infringing them. If the Judge does not consider himself conversant enough with the art to which the invention belongs, to allow him to form a confident opinion, he appoints three artists, to enquire whether the alleged invention of the patentee is novel, and whether there has been an infraction of it by the defendant. The report, which is made by this commission, includes a full exposition of the questions of science or of art, which are involved in the case. It is open to a free canvass afterwards, by the counsel of the parties, before the Judge;—and his adjudication follows. I should think this feature of the French system, an excellent one. We have something analogous to it, in our proceedings in Equity, where we occasionally invite a similar report from scientific men;—but I do not see why it should not be introduced also into our actions at law, as a substitute for the jury trial, which we have inherited from the English system.

Nor do I see the necessity of leaving the public in uncertainty, as to the extent or validity of a patentee's rights, until some one has been daring enough to violate them, and they have been vindicated after the infraction. The question may be settled just as well before, more speedily as well as economically for the patentee, and much more safely and beneficially for the public. Here, again, I think the French law wiser than our own. "Every man," says one of its commentators, *(Perpigna, ch.* 5, § 2.) "before he begins a commercial undertaking, which may require the investment of a considerable capital, has a right to ascertain whether or not the supposed privilege exists; because, as the patentee proclaims his exclusive right, every one concerned in the trade, with which the patented invention may be more or less connected, is in constant fear of involuntarily infringing the patent-right, and running the risk of a prosecution and condemnation for piracy." The very moment, therefore, a patent is granted under the laws of France, every one has a right to bring an action for the repeal of it.

Not only would I be disposed to allow every one to contest the validity of a patent-right, in advance of a law suit to recover damages for infringing it; but I would admit no controversy as to the validity of a patent, in a suit founded on its infraction. I would hold letters patent under the great seal of the United States, to be conclusive evidence of their own validity, so long as they remain unrevoked by a judicial determination. But I would permit the man, who is charged with violating them, as I would permit every other man, to institute proceedings for revoking them at any time.

Of course, such proceedings, to make them conclusive upon the public, must be well guarded against collusion and abuse. They should be conducted with great publicity, and preceded by ample notice,—the specific grounds, on which the patent is to be contested, should be clearly and fully declared beforehand,—all persons whatever should be allowed to

join in sustaining them by facts and arguments,—and the Attorney of the United States for the District, or perhaps a professional representative of the Government, specially appointed to attend upon such investigations, should take part in the case, though without so controlling it as to thwart the action of others. But when such a controversy has been conducted publicly and fairly, I see no reason why the patent, if found fraudulent or defective, should not be declared to be so as to all the world, and thereupon revoked,—nor why, if the patent has withstood successfully the assault of all comers, it should not be exempt from future controversy upon the points solemnly adjudicated in its favor,—leaving it open to impeachment thereafter only upon grounds not before in contest.

A patent, renewed after the expiration of its first term, for causes such as now justify a renewal,—signal merits, namely, and inadequacy of compensation for the good rendered to the public,—I should hold for that reason alone, protected against all further attack on the score of originality or usefulness. Fourteen years, either of general acquiescence in his title, or of successful litigation in defence of it, should earn for the meritorious and ill-rewarded patentee a parting season of repose. *Solve Senescentem.*

This is not an occasion, which could tempt me to elaborate the details of such alterations as I have suggested; and I am sensible, that it must be the work of more time, and more familiarity with our patent system, past as well as present, than belong to me. But it is conceded, that the law as it stands is sorely in need of revision; and it is perhaps the duty of every one, who has been constrained to remark its defects, frankly to suggest what appears to him the most simple and effective remedy.

I trust, too, that I shall not be thought to have chosen an improper forum, before which to make these suggestions. There is no Institution, that exerts so important or so beneficial an influence over the inventive genius of our countrymen, as that before which I am standing at this time;—there is no body of men, among whom it is so easy to find intelligent and skilful counsellors, upon every question, which can interest our mechanics:—and I do not know of any, whose judgment I would so cheerfully defer to, on questions connected with the patent laws. No one, who remembers what mechanics and the arts *were* in Philadelphia, and who sees what they *are*, but bears grateful testimony to the value of the lectureships of the Institute, its public meetings, the labors of its committees, its exhibitions, and its system of premiums, in elevating the tone of our industrial classes, improving their modes of work, stimulating the spirit of invention among them, and enlarging their sphere of thought.

The effect of all this action upon the progress of mechanical science among us, must go on continually increasing. In the old countries, as manufactures have become matured, the division of labor has had a manifest tendency to check improvement in the arts. The artificer, whose whole business of life is to graduate an arc, or to set the knife edge of a scale-beam, will no doubt become apt at his work;—but he cannot be expected to devise modifications of the theodolite or the balance. If he were even to imagine a change for the better in the work which forms his limited department, he could not carry it into effect; for he knows too little of the rest of the machine, to enable him to modify its parts, so as to admit his improvement.